

# MINING WORLD



MAY 1959  
VOL. 21 NO. 6

Kiruna's Central Plant...  
Nine hoists — magnetic concentrator

Page 32



*Imagination...is the source of human  
improvement; experience its implement"*



## NEW PROGRESS IN COPPER—BY KENNECOTT

Arizona has a new landmark, the world's most modern copper smelter. Its giant, 600 foot stack thrusts skyward from the desert at Hayden, Arizona, a dramatic symbol of progress in copper, a tribute to knowledge, advanced technologies and the vision of Kennecott Copper Corporation.

This marvel of copper production, utilizing the most advanced methods, industrial skills and equipment, promises substantial supplies of the much-needed red metal for a world of home and industrial uses.

WKE—Western-Knapp Engineering Co.—designed, engineered and built the new Kennecott Smelter. Close cooperation and coordination between the men of WKE and Kennecott achieved a high degree of efficiency through every phase of development.

Should you be considering plant construction or expansion, we would like to explain how the WKE approach to modern plant development results in more plant per dollar spent.

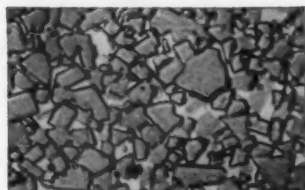
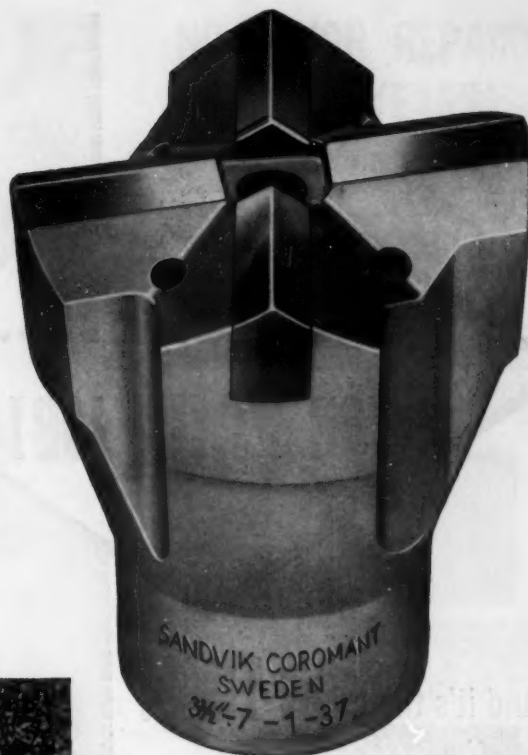
We will be happy to send additional information on the new Kennecott Copper Smelter or other projects covering a wide range of industries—on request.



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Building for the Future—in a World of Industries



# Longer bit life— with *new* Sandvik Coromant Bits



**Sandvik Coromant Tungsten Carbide**  
(Microphoto) Uniformity of size, even distribution of grain are marked. Free from porosity and impurities—therefore stronger, longer-lived.



**Low quality Tungsten Carbide**  
(Microphoto) Black marks are contaminations caused by deficient production control. They weaken the carbide, reduce its working life.

## Sandvik Coromant Detachable Bits are Available in the following Thread Sizes and Bit Diameters

		Available Diameters, in Inches																		
Type	Thread	1¼	1½	1⅝	1¾	1⅞	2	2¼	2½	2⅝	2¾	3	3½	4	4½	5				
SHOULDER	TAPER	x	x	x	x															
	F		x	x																
	113		x																	
	H			x	x	x	x	x		x										
	115			x	x															
	D						x	x	x	x	x	x	x	x						
BOTTOMING	K													x	x	x	x			
	1" Rope				x	x	x	x		x										
	1¼" Rope						x	x	x	x		x		x						
	400						x	x		x										
	1½" Rope											x	x	x	x	x				
	600											x	x	x	x					
	700												x	x						
	J7.5																x	x		
	2" Rope																x	x	x	
	1000																	x		

**N**EXT time you buy bits, specify Sandvik Coromant because they give more footage per bit, lower drilling costs. Here's why:

- 1 Only first-quality tungsten carbide is used—as shown in the microphotos above. This means less wear, longer life and a better job.
- 2 The bodies are precision-made of high quality alloy steel—tough enough to take the strain throughout the extra-long bit life.
- 3 The bigger Sandvik Coromant bits are all of X-design, which prevents rifling. No wonder Sandvik Coromant inserts are the most widely used in the world, drilling more than one billion feet every year.

SANDVIK COROMANT bits are supplied through Atlas Copco, the world's largest manufacturer of rock drills, who also supply Sandvik Coromant integral steels—the most widely used in the world—and Sandvik Coromant extension steel equipment.

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**Atlas Copco**

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# Mining World

Including the Export Edition WORLD MINING

Published monthly except in April when publication is semi-monthly

VOLUME 21

MAY 1959

No. 6

## OPERATIONS—TECHNOLOGY

### Ore Dressing

#### Automated Quality Control of Ore Grading at Kiruna ..... 32

By AXEL KJELGAARD

One of the world's iron ore concentrating plants, in Sweden, treats a feed that is highly variable in composition. The concentrate must be split into five different grades. To meet this requirement data processing must be mechanized for control and dispatch of ore cars.

### Mineral Economics

#### Is Columbium Headed For a Boom? ..... 33

A review of the predicted supply-demand relationships and the cost factors that are expected to influence the columbium picture in the future.

### Metallurgy

#### Three Ways to Use Fluid Bed Reactors For Smelting ..... 42

By SIGMUND SMITH AND FRED STUBBS

A discussion of three United States patents for the reduction of iron, lead and zinc ores or concentrates to metals in view of advanced technology in the use of the fluidizing technique.

### Mining

#### How Pillars Are Pulled at a Trona Mine ..... 44

Intermountain Chemical Company's mine in Wyoming is characterized by a weak back and soft floor. Systematic pillar splitting behind protective fenders of ore allows controlled caving of the back for relief of weight.

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### ON THE COVER

One of the world's most unusual mills is pictured on the cover. It is the new iron ore beneficiating plant at Kiruna, Sweden, which is 11 stories high and 375 feet in length. The building is centered over eight shafts which are interconnected to underground crushing facilities.



MILLER FREEMAN PUBLICATIONS



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## NO MAJOR REPAIRS IN 25 YEARS\*

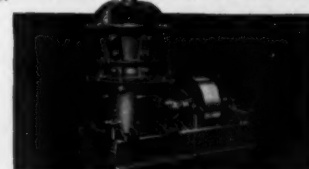
### Sturtevant Construction Assures Long Mill Life at Top Loads

Sturtevant crushing and grinding machinery answers the long life top-load production problem for medium to small size plants. Many Sturtevants have been operating above rated capacities for more than 25 years, and without a major repair.

"Open-Door" design gives instant accessibility where needed — makes cleanouts, inspection and maintenance fast and easy. Machines may be set up in units to operate at equal quality and capacity.



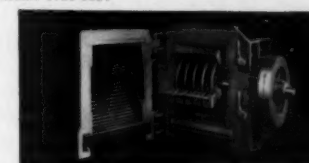
**Jaw Crushers** — Produce coarse (5 in. largest model) to fine (¼ in. smallest model). Eight models range from 2 x 6 in. jaw opening (lab model) to 12 x 26 in. Capacities to 30 tph. All except two smallest sizes operate on double cam principle — crush double per energy unit. Request Bulletin No. 062.



**Rotary Fine Crusher** — Reduce soft to medium hard 3 to 8 in. material down to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest, 10 x 30 in. Non-clogging operation. Single handwheel regulates size. Request Bulletin No. 063.



**Crushing Rolls** — Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls; Plain Balanced Rolls; Laboratory Rolls — all may be adjusted in operation. Request Bulletin No. 065.



**Hammer Mills** — Reduce to 20 mesh. Swing-Sledge Mills crush or shred medium hard material up to 70 tph. Hinged-Hammer Pulverizers crush or shred softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers with feed openings from 12 x 12 in. to 12½ x 24 in. Request Bulletin No. 084.

\*Reports Manager W. Carleton Merrill concerning Sturtevant Swing-Sledge Mill at James F. Morse Co., Boston.

**STURTEVANT  
MILL COMPANY**

157 Clayton St., Boston 22, Mass.

# Right off the Wire

21. Simplex takes pleasure in extending an invitation to old friends and new to visit their Booth #1611 at the American Mining Congress Coal Show, Cleveland Public Auditorium, May 11th through May 14th.

22. A 600-passenger ocean liner which will run on hydrofoils is in the design stage.

23. The first rocket-camera has been used to photograph cloud formations over the Atlantic.

24. An electrostatic device can separate particles of different materials. It can sort flour milling stocks, separate grains of different minerals and distinguish between healthy and unhealthy seeds.

25. A new magnetic recording tape has a protective lamination over the oxide to prevent wear.

26. A solid electrolyte battery has been developed that is said to be suitable for commercial production.

27. There are now three large offices where individual desk telephones can be reached from the outside by direct dialing.

28. Mercury batteries reduce the weight of a clock radio, made especially for travelers, to less than three pounds.

29. Stereophonic radio has hitherto required both AM and FM for transmission. A new method uses AM only.

30. The light from a recently patented underwater flash bulb is of such brief duration that fish are not frightened by it.

31. Crevasses in glaciers or ice fields can be detected by a device that can be carried in an airplane. It measures the difference in heat radiation between solid and hollow ice and records on film.

32. Tissues, akin, veins, arteries and circulating blood are all realistically simulated in an imitation human body designed for first aid training.

33. A heating element for use in floors or walls is made of paper in which copper strips are embedded.

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

34. A patent for an acoustical method of stimulating the flow of oil wells has been issued. The sound waves will actually shatter rock.

35. For the first time, an airplane has been guided over land by a missile system using radar to scan a photograph of the terrain.

36. An attachment for a telephone intended for use by a number of people kills germs with ultraviolet light.

37. Electroluminescent panels that emit cool light from a flat glass plate are now made in six colors.

38. Entirely new principles of heating and cooling are used in a unit that keeps foods hot or cold. It is mounted on wheels, uses batteries for power and can be rolled anywhere in or out of the house.

39. Ticker tape is being projected on a screen with letters and figures two feet high at the New York Stock Exchange.

40. A method of bouncing short waves off man-made reflectors in the sky has been patented. It can be used for radio or television.

41. America's annual bill for corrosion is 6 billion dollars, according to recently revised figures. Simplex Wire & Cable Co. has prepared a bulletin on this expensive problem and the most effective means of combating it. Write for Bulletin 1033.



Thirty-eight years ago Simplex Wire & Cable Co. announced the TIREX line of rubber-jacketed and insulated cords and cables to the mining industry. These cables featured the Simplex developed "cured-in-lead" process which produced a dense, tough and yet highly flexible sheath. To an industry plagued by severe operating conditions, the TIREX line of power and control cables provided unmatched dependability and service life.

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# Mining World

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MILLER FREEMAN PUBLICATIONS

MAY 1959

# Drifts and Crosscuts

## Is Geophysical Bill Answer to Exploration?

There is no question but that the science of ore finding has made rapid strides in the last few years. Interest in geophysical, geochemical, and geological prospecting continues at a high level in the United States. In Canada, a record season appears ahead.

But, one of the surprising things here in the United States, in contrast to Canadian activity, is the feeling by many companies, their officers, and consultants, that the mining laws must be changed. They feel that it is necessary to be able to stake a temporary geophysical claim over a very large area and hold it for up to two years while determining if it is possible to develop a mine.

It takes time, money, and lots of ground for today's big-target exploration goals. That's why many Americans feel a new law is needed before they can find new mines.

In Canada, which has larger sized claims, but limits the number an individual can stake in one year, there is no lack of exploration. On the contrary, many groups make a business out of selling their services for claim staking. Once a geophysical survey and discovery has been made, they contract rapid and accurate staking of large areas.

It costs money to do assessment work in both countries; more in Canada because of more detailed rules as to what constitutes assessment work. In this connection, Ontario has a drive on to eliminate "too easy assessment."

Now that geophysical work qualifies in the United States for assessment work under public law 85-876, there is an incentive to do this type of prospecting.

Some argue that a geophysical claim law would entice many large companies into prospecting. Would this shut out smaller companies, though? Canadian miners who do not have such a law seem to feel it is not needed.

Rather than a new claim law, a more important stimulus for exploration is removal of the existing four-year limitation on the deduction of exploration expenditures as proposed by Representative Howard Baker, of Tennessee, in H. R. 4251.

"Discovery of new reserves is literally the life blood of the mining industry," Congressman Baker said. "Encouragement and stimulation of exploration of new mineral deposits are essential to both economic progress and national security." The current limitation on deductibility of expenditures for exploration, he explained, constitutes a serious impediment to mining development.

The present law also places a maximum deductibility of \$100,000 on exploration costs for any one year. Congressman Baker said that while this provision constitutes a "roadblock" in the research activities of some companies, he will not recommend that it be removed at this time when revenue requirements are so vital to the Treasury.



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Gates brings you, through *Specialized Research* in V-Belts, another important cost-saving advance:

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Today, all Vulco Ropes in Gates distributor and warehouse stocks have the new higher horsepower rating.

See the Yellow Pages of your phone book for your nearest Gates V-Belt distributor.

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For new drives, Gates now offers you the new *Super HC V-Belts and Sheaves*—the most advanced concept in power transmission in 25 years. The Super HC Drive is far more compact... takes up to 50% less space. Costs less, too. You save as much as 20% over present V-Belt drives. Ask your nearby Gates distributor for Handbook DH-900 entitled, “The Modern Way to Design V-Belt Drives.”

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# V-Belts



# MINING WORLD NEWSLETTER

Atlantic City . . . Salem . . . Eureka

May 1959

Western taconite moves to the fore as Ruby Company's Wyoming patent application indicates 300,000,000 tons on property leased to U.S. Steel for 75 years.

Columbia-Geneva has spent \$467,000 in exploration to indicate that ore.

Simultaneously, Columbia-Geneva engineers in San Francisco have completed 80 percent of detailed designs for crushing plant and upgrading concentrator.

An appropriation from U.S. Steel's Board of Directors could start construction.

The exploration scene switches to southeastern Missouri!

American Metal Climax follows close on the heels of Bear Creek Mining Company, in setting up mineral exploration offices in Salem, Missouri.

Discoveries of lead by St. Joseph Lead in Viburnum and copper by American Zinc in the Boss-Bixby district have enticed the new entrants.

Nevada's vanadium boom is picking up speed and steam.

Union Carbide Nuclear's prospecting (first reported in Mining World, May 1958) is said to have indicated millions of tons of 0.72 percent  $V_2O_5$  to depths between 200 and 300 feet. Drilling, trenching, and bulk sampling have been impressive.

Now two major copper companies are investigating claims north of the discovery.

The future of the uranium industry, as forecast by two of its prominent leaders, appears promising. Both predict demand will exceed production by the 1970's.

The presidents of Atlas Corp. and Rio Tinto Mining Co. of Canada anticipate increased consumption will come from civilian nuclear power plants, larger military requirements by conversion of world navies to nuclear power, and new civilian uses of nuclear power, such as process heating in industry and space heating in homes.

AEC uranium ore reserve estimates on January 1, 1959 totaled 82,500,000 tons.

Canada's lower grade reserves are figured at more than 350,000,000 tons.

Gold dredging interest seems to be reviving around the world.

Part of the reason, perhaps, is that today one can buy a used gold dredge at less than the pre-World War II cost. What other major piece of mining equipment can be acquired at such low capital investment?

Increased sales of small washing plants reflect the increased interest, too.

Most of the activity centers in Latin America. South American Placers bought a dredge from Bulolo and had it shipped in to Bolivia from New Guinea; Northshore Goldfield Mines plans to ship a dredge from Sierra Leone to its new operations in Surinam; Natomas Company is test drilling a gold concession in Ecuador; Yuba Mining Division of Yuba Consolidated has a new agreement to prospect Chiloe beach sands in Chile for gold.

Canada's Quebec Province has attracted New York-Alaska Gold Dredging Corp., which is now participating in a gold placer operation called Beauce Placer Mining.

In the Philippines, Lepanto Consolidated is sampling a second placer gold deposit on Mindanao after the first prospect was too low in grade.

Korean dredging grounds are attractive, but multi-ownership of small plots makes it complicated to lease blocks of ground. Natomas Co. has been drilling.

Nevada's Round Mountain Gold Dredging Corp. is doing better in its second placering attempt than it did several years ago. It is now working selected areas by different mining methods.

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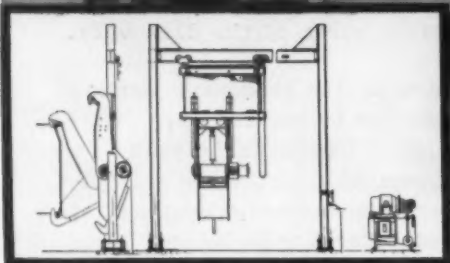
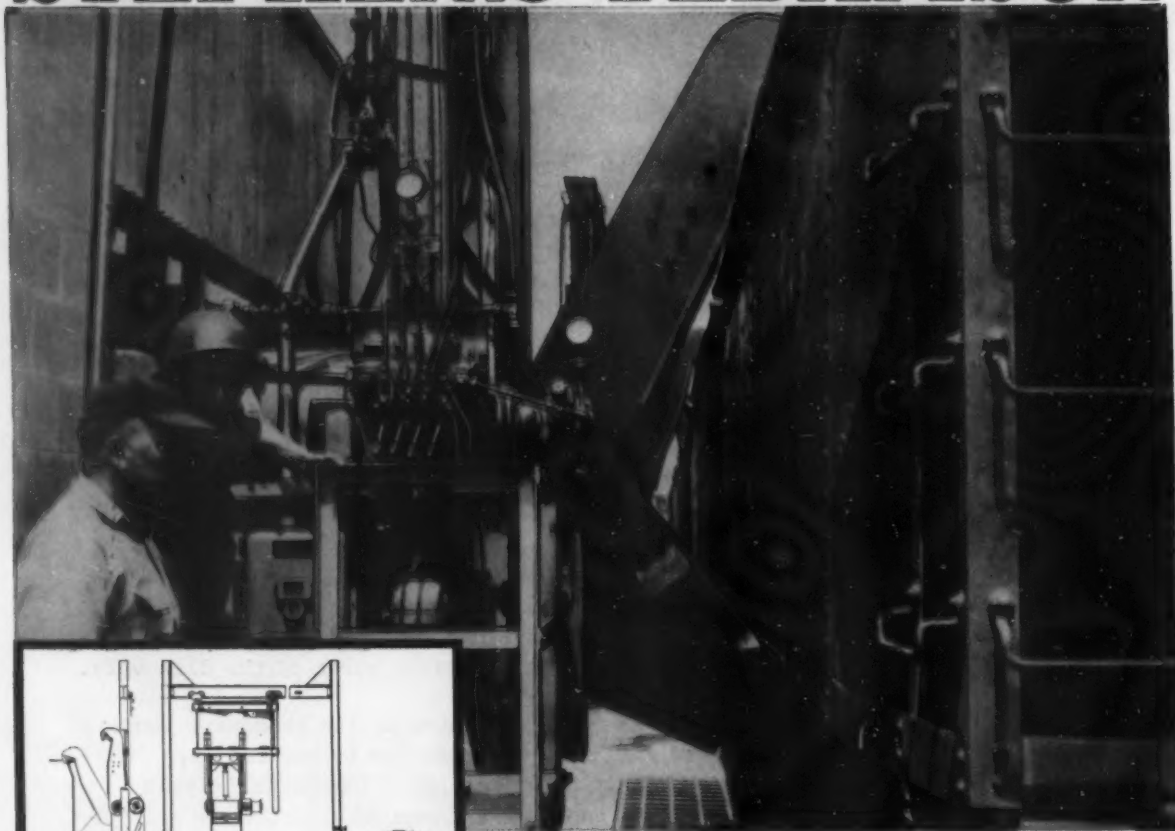
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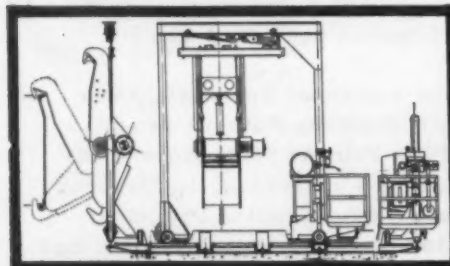
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# Capitol Concentrates

## Manganese Bonus Plan Calls For Incentive Payments For Ore Sold On Open Markets

Because of the present stockpiling policies, the government is not expected to extend the carlot manganese program when it is completed—probably in the third quarter of 1959. It also is most unlikely that the Administration would approve any attempt by the Congress to continue stockpile purchases of domestic manganese.

With foreign manganese of metallurgical grade priced at around \$1.10 per unit, while the domestic carlot program price is \$2.30 per unit for substandard grade, domestic manganese production probably is doomed to extinction at the end of the current program. Manganese, therefore, will follow tungsten down the drain—unless some substitute program is worked out.

The Metcalf bill, H. R. 5631, based upon the Seaton incentive payment program, is designed to keep the manganese industry operating without government purchases. If this bill becomes law, the government would pay to domestic producers \$1.00 per long dry ton unit as an incentive bonus for each unit sold in the open market. If we need a manganese industry for our mobilization base and do not need to add to the national stockpile, this is the best and the cheapest way to preserve it.

### ● Secretary Seaton Expresses Little Optimism

Secretary of the Interior Seaton, at a press conference on March 20, practically repeated what he told the House Interior Mining Subcommittee early in the year, when he said that he is not optimistic about stabilizing the lead-zinc market. This no doubt means that the Secretary does not expect anything constructive to come from the United Nations conference and that he probably will propose no stabilizing legislation. Furthermore, it may be a warning that if Congress comes up with something it may not be approved.

### ● New Twist Given Lead-Zinc Bill

Early in 1957 Senator James E. Murray, chairman of the Senate Interior and Insular Affairs Committee and also chairman of that committee's mining subcommittee, introduced a lead-zinc bill which was based on the National Sugar Act. It would have authorized the Secretary of Commerce to adjust import quotas so as to maintain domestic lead and zinc prices at reasonable levels.

This year, Senator Murray, together with 13 other sponsors has introduced S. 1566, which is substantially the same bill except for specifying somewhat lower minimum domestic price limits, i. e., 15.5 cents per pound for lead and 13.5 cents per pound for zinc, or a combined price of 29 cents. The new bill also includes a provision which would authorize barter contracts for lead and zinc with such countries as would be injured by the new quota system. This provision, it would seem, is an attempt to keep from damage foreign nations which might be offended by the new quota system. Lead and zinc bartered for agricultural products would be locked up in the supplemental stockpile, therefore creating no peril to domestic markets.

This new twist, which was first included in the fluor-spar bill, was a happy thought. Whether or not the Administration will go for it remains to be seen. That the

State Department will approve the bill is believed highly questionable, and there may be considerable consumer resistance.

### ● Percentage Depletion Measure May Be Pigeonholed

The Administration's bill to redefine percentage depletion is expected to be pigeonholed, at least for this session of the Congress. The southern members of the House Ways and Means Committee very likely will see to it that nothing is done, for the time being at least.

The Administration has requested legislation to determine specifically the point in processing after which depletion will not apply. One reason for the request was that clay and brick have been subject to court decisions which carried the calculation of percentage depletion well along into what might be considered part of a manufacturing rather than a mining process. A good many of the affected operations are in the South.

### ● Interior Department's Position Is Explained

When asked about the department's minerals program, during his confirmation hearings for the position of Under Secretary of the Department of Interior, Elmer Bennett stated: "At the moment perhaps the most immediately pressing problem is the problem of lead and zinc. We have the quotas in effect. We are not quite certain whether it is purely a question of inventories or whether some inadvertent loopholes have appeared in the proclamation dealing with those quotas. But we do know that the effect has not been as fully satisfactory as we had hoped it would be." He also reported that a complete study is being made "to analyze what, if anything, needs to be done to achieve the result that the President's proclamation was designed to do. . . ."

Bennett indicated that Interior Secretary Seaton had not made a final determination whether he should submit to the Congress a new program for the other minerals which are in distress. However, in a prior hearing before the House Interior Committee, the Secretary himself gave a quite definite impression that he was not inclined to submit such a program.

### ● Silver Purchase Act Is Under Attack

Representative Emanuel Celler of New York once again has introduced his bill to repeal the Silver Purchase Act. H. R. 66, however, would provide that all outstanding silver certificates are covered and exchangeable on demand for silver dollars, as they now are. This would insure that our only "convertible" currency, backed 100 percent by metal, would continue to be sound. Still, the measure would be poor comfort for producers of silver, the price of which is now supported by the U. S. Treasury. It might make the flatware manufacturers happy if the Celler bill resulted, as he expects, in lowering the price of silver so that a few cents more profit could be made on a set of spoons.

Fortunately the Celler bills, like the Green bills, have so far been headed off in the Banking and Currency Committees. It must be pointed out though, that by some feat of parliamentary magic, Representative Celler got his bill referred to the House Committee on Ways and Means, the reaction of which to silver legislation is unknown.

**PROJECT PAYDIRT\*** *pays off again*

# NEW 225 HP CAT NO. 619 TWO-WHEEL TRACTOR



- **First two-wheel tractor to deliver four-wheel speed and roadability!**
- **Matched with new No. 442 Series B LOWBOWL Scraper for new high production with 14 cu. yd. struck capacity!**

This new No. 619 Series B represents a major breakthrough in two-wheel tractor-scraper design. It is the first and only broad application two-wheel machine that combines two-wheel traction with four-wheel speed and roadability. It also affords new unit construction and timesaving accessibility never before built into this type of rig.

The No. 619's new turbocharged engine delivers 225 HP and a torque rise of 20%—higher than any in its power range. With a top speed of 30.2 MPH, the No. 619 can really run—and run under conditions that slow down other make two-wheel rigs.

That's because of its roadability. Advanced Caterpillar design has achieved a tractor-scraper balance resulting in rides that "smooth out" to an amazing degree. This balance permits higher speeds for more cycles per day and less operator fatigue.

With all this, new hydraulic steering makes the No. 619 extremely easy to maneuver, yet retains that important "feel of the road" touch. Design permits full 90° turns with a turning diameter of 30 feet.

As for unit construction and accessibility, here's one example: A new swing-away dash allows ready access to the starting engine, air compressor and hydraulic pump. Another example: By removing six capscrews in the planet carrier cover, each axle can be removed from the tractor. The planetaries are interchangeable between sides.

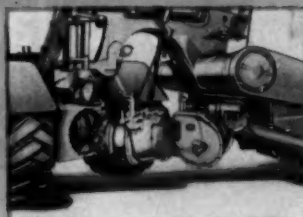
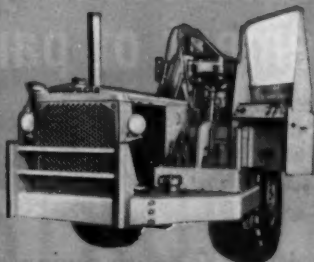
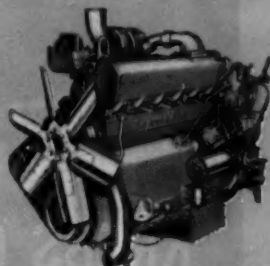
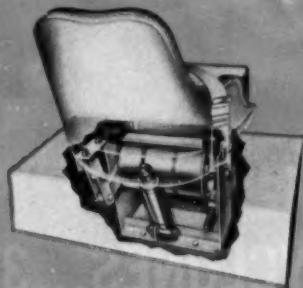
Like all achievements of Caterpillar's Project Paydirt, the No. 619-No. 442 unit has been thoroughly tested. Four years of on-the-job operation prove this: This new "all-job" machine will set new performance records on a broad range of applications.

How much does this mean to you profit-wise? Of course, that depends on your jobs. But this is certain—there's nothing like the new No. 619-No. 442 in the field today. Get the complete facts about it from your Caterpillar Dealer, who backs you with round-the-clock service and parts you can trust. Ask for a demonstration. See for yourself how it can step up production and profits on a wide range of applications.

Caterpillar Tractor Co., San Francisco, Cal.; Peoria, Ill., U.S.A.

**NEW TORSIONFLEX SEAT.** New seat provides "highway" ride on off-highway conditions. Helps conserve operator's energy, lessens his fatigue, enables him to do more work per shift. One of many Caterpillar developments.

**NEW TURBOCHARGED CAT ENGINE.** Designed to meet the specific requirements of the No. 619. Develops 225 HP and a full 20% torque rise—for fast acceleration from cut. Fuel system permits use of economy-type fuels.



**NEW NO. 442 SERIES B LOWBOWL SCRAPER.** Matched to the No. 619 for high production. Capacities: 14 cu. yd. struck and 18 cu. yd. heaped. Exclusive Caterpillar LOWBOWL design provides a faster loading rate with less resistance throughout the loading cycle. Also available for use with the No. 619 is the 25-ton-capacity Athey PR619 Rear Dump Trailer.

**NEW SWING-AWAY DASH.** Permits timesaving access to the starting engine, air compressor and hydraulic pump. Entire left side of engine can be exposed without having to disassemble any major components connected with dash.

**NEW UNIT CONSTRUCTION.** Offers unmatched accessibility for servicing. Transmission differential and cable control can be quickly removed as unit. Each axle can be pulled out by removing six cap-screws from planet carrier cover.

**Additional facts about the No. 619-No. 442—**Six-speed forward, two-speed reverse constant mesh transmission • Standard wide-base 26.5-25, 24-ply tires all around—optional tread and ply ratings available • Choice of in-seat gasoline starting or direct electric starting • New dry-type air cleaner • Fuel tank capacity—85 U. S. gallons • Shipping width—10 feet, 10 inches.



**\* PROJECT PAYDIRT:**

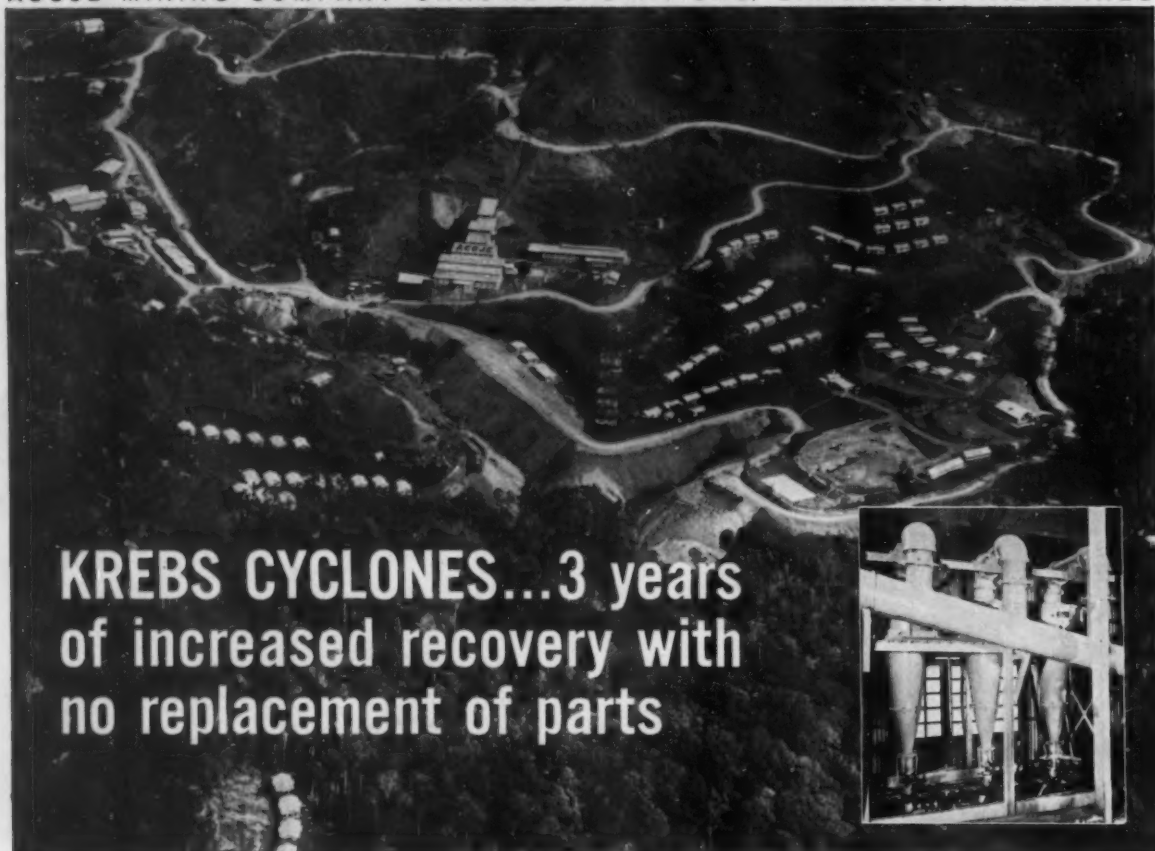
Caterpillar's multimillion-dollar research and development program—to meet the continuing challenge of the greatest construction era in history with the most productive earthmoving machines ever developed.

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Equipment Engineers' Pilot Plant in Palo Alto, California, made full scale studies of Acoje samples prior to the installation and results were confirmed in the Acoje plant. Our Palo Alto facilities are being expanded that we may continue to serve the Mineral Industry more effectively.



## **EQUIPMENT ENGINEERS INC.**

737 LOMA VERDE AVENUE  
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# NOW! A

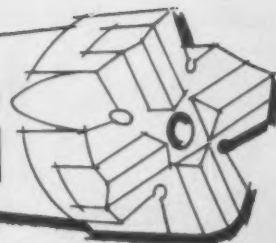


## REMOVABLE

## AIR-LEG BIT

## THAT'S

## ONE-PIECE STRONG



**I**T'S removable—yet the new Timken® tapered socket carbide insert bit for air-leg drills is one-piece strong. With this tapered union you get all the advantages of removability, and the strength of one-piece steel.

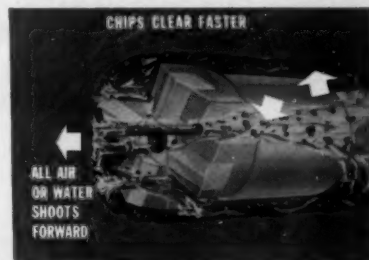
Removability of the new Timken tapered socket bit gives you all these advantages you can't get with intraset steels:

- 1) No need to throw away good drill steel when the carbides wear out. With intrasets you have to throw away good steels.
- 2) A pocketful of bits is enough for a day's work. You haul an armful of steel with intrasets.
- 3) You can change bit gauge sizes fast on the same steel. Using intrasets, you have to change the whole steel.
- 4) You carry only the bit to the shop for resharpening. With intrasets you lug the whole steel.
- 5) You get longer gauge wear because there are four

carbide cutting edges. Most intrasets have only two.

The new Timken tapered bit's new frontal design features clear chips faster (right). And you get superior wear-resistance with added shock-resistance because of new special-analysis carbide inserts. They can be reconditioned many times.

To get removability *plus* strength, get the new Timken tapered bit. For free brochure, write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".



**CHIPS CLEAR FASTER** because 1) five front holes shoot water or air directly against the rock face and 2) deeper, wider wing clearance lets chips wash back faster.

# TIMKEN®

**AVAILABLE NOW!**

**THE AIR-LEG BIT  
OF THE FUTURE**

## NEW BATTERY PLATE CONSTRUCTION

Unique new double-sleeve, multi-tube positive plate construction permits greater volume of active material per tube and greater accessibility of electrolyte to the material — providing greater capacity for brighter, better light with no increase in plate size. Long battery life with increased resistance to vibration and hard use are plus advantages.



# NOW



## A PERFECT SPOT at your fingertips — either filament!

A finger-turn of the switch knob lights either filament of the powerful equal-filament bulb—and at the same time achieves a perfect, brilliant spot! No tools, no fums or tinkering. Anyone who can turn a switch can focus an ideal spot with WHEAT—instantly!

# **- a MAJOR ADVANCE** **in better light for the miner!**

## **THE WHEAT National** **MODEL** **MINER'S ELECTRIC CAP LAMP**

In a single step, WHEAT moves out front in better light, greater utility, top service for the worker underground! The WHEAT *National* Electric Cap Lamp incorporates advances in battery, bulb and focussing beyond comparison in the field today—retains every factor of dependability, simplicity and ease of maintenance that have made WHEAT the leader in sales increase for the past decade. See your National Mine man now, and talk WHEAT NATIONAL for its very good reasons!

### **30% MORE LIGHT** **at no increase in weight**

Advanced, exclusive new battery construction joins with efficient new krypton-filled bulb to achieve unrivalled light output in a miner's electric cap lamp today . . . 30% more light than even the high-powered Wheat Forty-niner! For the *most* light for the miner throughout the working shift, specify WHEAT NATIONAL.

### **TWO WORKING FILAMENTS** **in Krypton gas-filled bulb**

Each of the two identical filaments in the new Wheat krypton-filled bulb is a full-power working filament. If one burns out, the other is instantly available at equal high brightness—and is focussed instantly to an equal perfect spot. Only WHEAT NATIONAL offers this operating ease!



**National Mine  
Service Company**



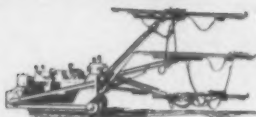
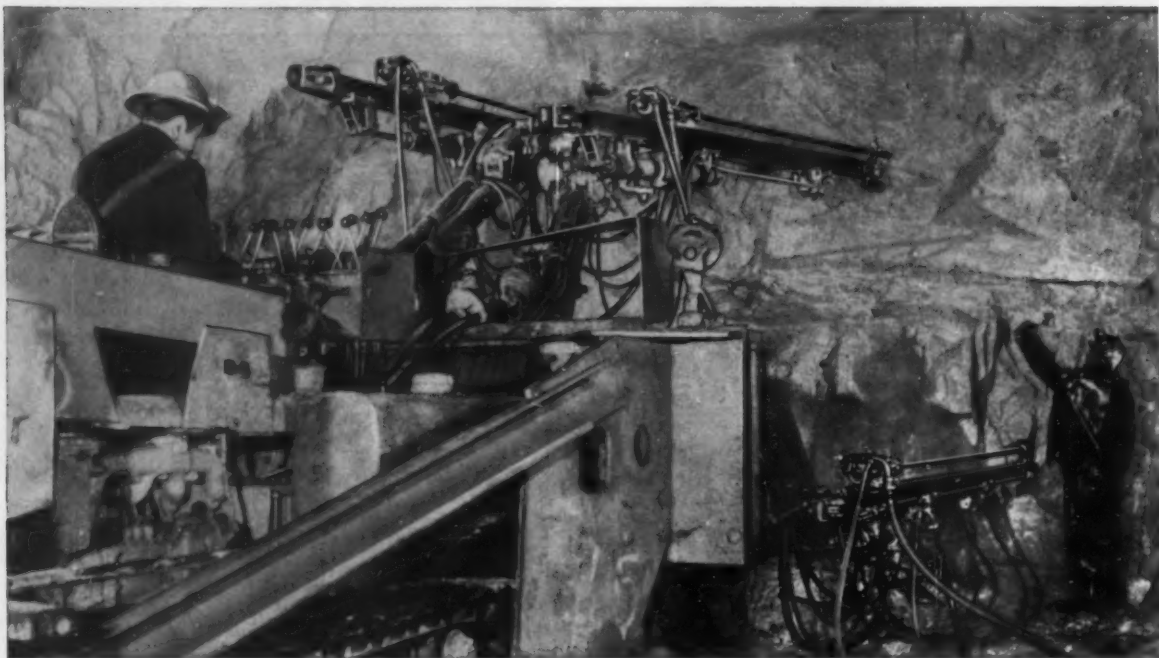
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# HYDRA-BOOMS

speed underground drilling  
in Canada's URANIUM MINING BOOM



Unlike the gold rush of Klondike days, the uranium boom in Canada's Algoma Elliott Lake area is spearheaded by the most efficient *mechanized* equipment. To speed up drilling with minimum effort, the Panel Mine of Northspan Uranium Mines Ltd. is using four Ingersoll-Rand Hydra-Boom drilling rigs, one of which is shown above, operating 1700 feet below the surface.

Each tractor-mounted rig carries three heavy-duty I-R drifter drills mounted on Ingersoll-Rand Hydra-Booms, providing smooth effortless hydraulic control of all drill motions. Booms are raised or lowered and swung from side to side and drill guides are extended, retracted, dumped and swung at the touch of a throttle—all drills easily

controlled by one rig operator. Using 1½" round steel and 1¾" tungsten carbide insert bits, these rigs are used in a room and pillar trackless mining operation, teamed with 48" ramps mounting 30-hp I-R slusher hoists.

I-R Hydra-Booms represent the last word in *mechanized* rock drilling—convert setup time into drilling time and increase production by as much as two-to-one. Rugged, versatile and easy to operate, Hydra-Booms are designed and built to withstand the punishment and abuse inherent in underground mining operations. Swing and lift cylinders are double acting, fast moving, and locked to prevent dropping the boom if hydraulic lines are broken.

Ask your Ingersoll-Rand drilling engineer for complete, cost-saving facts about I-R Hydra-Booms. Or send for a copy of new bulletin 4196.

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A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK



# In AFRICA

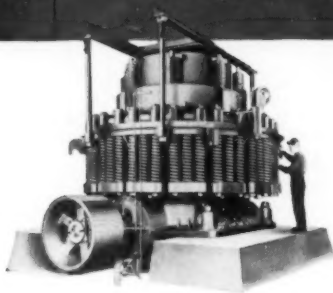
## ... SYMONS® CONE CRUSHERS

used for efficient reduction  
of ores and minerals

(Partial list of Africa's ores and minerals. Symbols indicate location of important deposits.)

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... as well as aggregates, cement rock, gravel, etc., for the construction industry.



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... The machines that revolutionized crushing practice ... are built in a wide range of sizes, for capacities to over 900 tons per hour. Write for descriptive literature.

In all of the great ore and mineral operations around the world ... there has been no record to equal the performance of Symons Cone Crushers in consistently and efficiently producing great quantities of finely crushed product at low cost.

In Africa, hundreds of Symons Cones are used by leading producers of most of the ores and minerals found in this giant continent. As an indication of its mineral wealth, it is significant to note that Africa produces almost 75% of the world's cobalt, 65% of its gold, 50% of its antimony, 33% of its manganese, chrome and phosphates, 25% of its copper, 15% of its lead and tin, a large part of its uranium and practically all of its diamonds.

The use of Symons Cone Crushers in Africa is another example of the way in which these efficient crushers serve the mining and mineral processing industries of the world.

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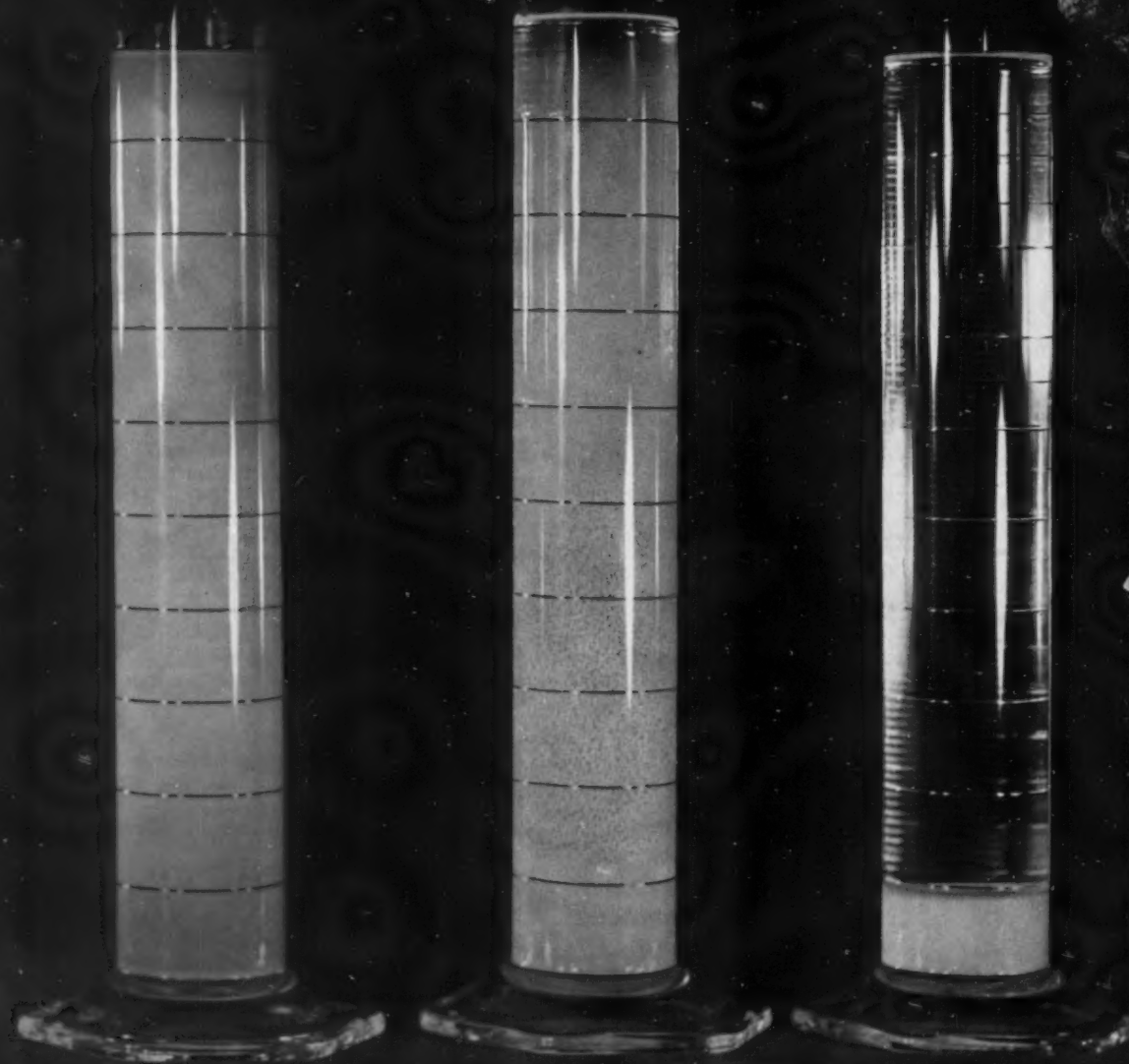
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# SUPERFLOC<sup>\*</sup> 16

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A new, highly-superior flocculating agent has been developed by Cyanamid—SUPERFLOC 16 Flocculant. This high molecular weight polyacrylamide product has consistently out-performed other synthetic and natural polymers in plant and laboratory trials as a filtration and settling aid.

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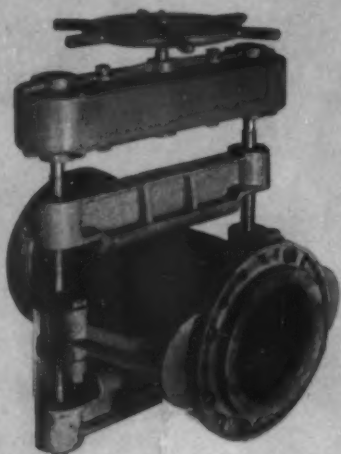
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*Non-metallic slimes settling with the aid of SUPERFLOC 16 Flocculant.*

*Clockwise from the bottom left the mineral specimens are: Orpiment - Fluorite - Azurite - Chrysocolla - Kyanite - Bauxite - Garnetite, dolomite - Carnotite - Native silver in calcite - Malachite - Native copper - Heterogenite - Gold quartz - Pitchblende, gummito - Chalcantite, pyrolusite in apatite - Gold-bearing conglomerate - Ilmenite - Native copper - Covellite - Amethyst - Carnotite - Silica - Ferbarite - Anthracite*

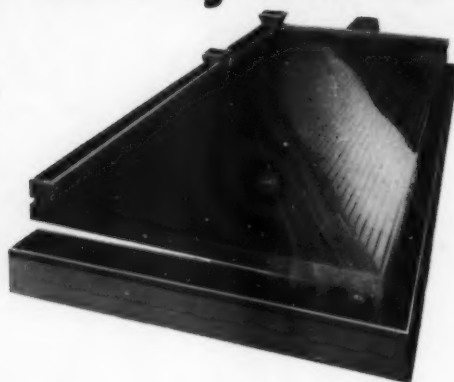
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- Remote control available.
- Can be equipped for automatic regulation.
- Closing mechanism... manual handwheel; handwheel with chain and sprocket reduction unit; electric worm gear motor reducer; chain operated torque arm reducer; hydraulic; air-hydraulic.

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many profitable  
applications  
in modern  
metallurgy

the genuine WILFLEY TABLE, as manufactured by Mine & Smelter, has been an important factor in the success of many metallurgical processes for years. There are still many applications where the Wilfley Table is of particular value and cannot be equalled for economical and efficient performance. Some of these are . . .

- Before or after flotation for recovery of mineral not readily recovered by flotation.
- As pilot tables following flotation to indicate efficiency of flotation.
- To concentrate low grade mineral producing a high grade concentrate for further treatment.
- To wash and clean inferior coals, iron ore, etc.
- In metal and reclamation plants.
- For two or more mineral separations from flotation concentrates, previous table concentration or from original table feed.

The Wilfley Table has an easily adjustable stroke from  $\frac{5}{8}$ " to 1", a speed range from 240 to 300 strokes per minute, an adjustable table inclination from zero to 1" per foot, and a selection of wood riffles of various depth and taper . . . all of which permit a flexibility to best meet the conditions of each application.

Wilfley Tables are available in two commercial sizes and two laboratory sizes. Drives available include: flat belt, constant speed V-belt, variable speed V-belt, variable speed motor drive. The tables may be equipped with steel channel understructure, or with base for mounting on concrete piers.

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## NI-HARD mill liners

...good to the last 1/4"

*Original liner 3 1/4" minimum thickness. Worn to 1/4" before replacement. No breaking.*

*No cracking. Outlasted unalloyed white iron 2.15 to 1 and manganese steel 1.46 to 1*

### MILL LINER MINIMUM THICKNESSES

If you are unacquainted with Ni-Hard\* mill liner segments, the table below will give you a rough guide to the minimum thicknesses for an initial installation. Thinner liners than these can and are being used based on individual experience, but the thicknesses contained in the chart are suggested as a starting point for the mill man who is thinking about using Ni-Hard liners for the first time.

### MINIMUM MILL LINER THICKNESS

MILL DIAMETER	SIZE OF GRINDING BALLS OR RODS			
	1"	2"	3"	4"
6	1.5"	2.0"	2.5"	3.0"
8	1.75	2.25	2.75	3.25
10	2.0	2.5	3.0	3.5

"Ni-Hard mill liner segments are available from authorized producers throughout the country. For the address of the one nearest you, write to Inco."

\*Registered trademark

**THE INTERNATIONAL NICKEL COMPANY, INC.**

67 Wall Street



New York 5, N. Y.

# NI-HARD

**NICKEL MAKES CASTINGS  
PERFORM BETTER LONGER**

"We've used International TD-24's on our job continuously for three years," reports Bobby Ikerd, for Ikerd and Bandy, Inc., Manchester, Ky. "Our first '24' has worked over 8,000 hours. We get good production with exceptionally long track life. Live track turning, planetary steering features, combined with hydraulic dozer, gives us a faster stripping operation in mountain terrain—plus operator safety advantages." Their 24's strip 30-foot earth-shale-rock overburden on 100-foot maximum push. Right: One of their "24's" rolling up production!

## PLANET POWERED "24's"

# hit stripping cost squeeze...with

"Planetary steering enables the TD-24 operator to cut more high-wall yardage per day, as live power on both tracks pulls out full dozer blades on a continuous move," declares Supt. Ken Ellis, Ford Mining Co., Charleston, W. Va. "The decelerator offers better tractor control. Our older TD-24 still has the same track system after 7,000 hours of work. Service like this sold us on our new '24.'" To support a coal-augering operation, their TD-24, shown, faces up to 300 lineal feet of bench daily—cutting a maximum depth highwall of 30 feet, in hard shale and sandstone.



"Our year-old '24' stripping overburden, and working in mud, sand, and gravel along the creek bed, keeps well ahead of the dragline," states Supt. C. G. Hendry, for Dallas Sand and Gravel Co., Inc., Selma, Ala. "Our TD-24 track life (they've owned three '24's') runs a good one-third longer than competitive crawler owners are getting around here." The company produces fluxing gravel, road rock, pea gravel, and sand for industrial and construction uses.





## **"live" track steering...long track life!**



◊ "The TD-24 planetary steering design combined with the torque-converter has greatly reduced tractor maintenance in our type of operation," reports R. D. Baughman Coal Company, Brookville, Pa. "Live power on both tracks enables the operator to push larger loads, always keeping the dirt rolling regardless of terrain conditions. My operators especially like TD-24 ease of control!" The Baughman Company strips up to 40 feet of shale, sand rock, and clay overburden from a 5-foot seam of coal.

See what's behind TD-24 ability to outdoze same-sized competitors, as much as 50%—and to give up to one-third greater track life than other makes, especially in tough conditions! See how exclusive Planet Power steering keeps paydirt on the move—doesn't spill your "extra profit" margin—eliminates "dead-track drag" in turns. Prove what it means to increase stripping production efficiency and cut upkeep with "24" capacity. See your International Construction Equipment Distributor for a demonstration.



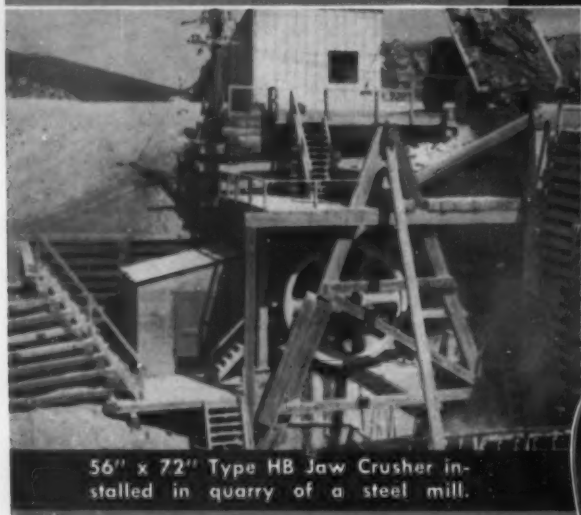
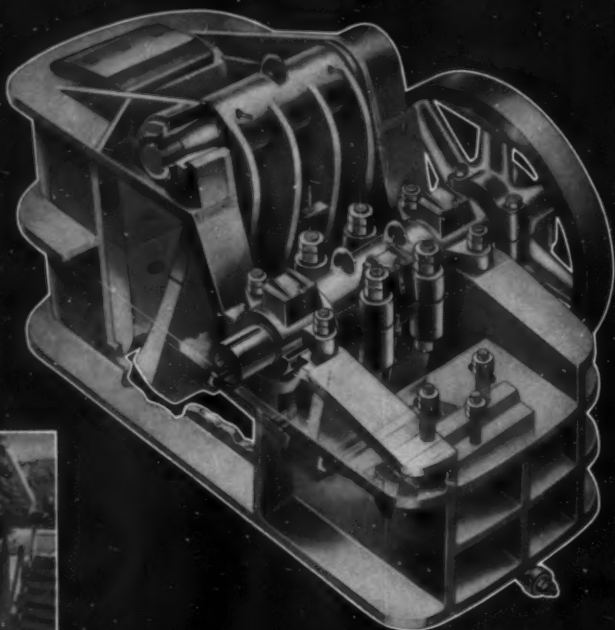
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Construction  
Equipment**

International Harvester Co.,  
180 North Michigan Ave., Chicago 1, Ill.

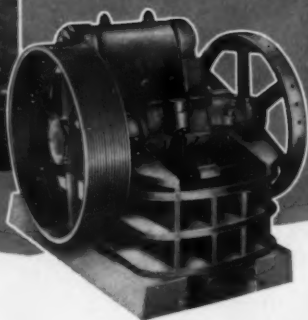
A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers and Bottom Dump Wagons... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

# Traylor-made H & HB Jaw Crushers

Cutaway view below shows the advanced design of Traylor type HB Jaw Crusher.



56" x 72" Type HB Jaw Crusher installed in quarry of a steel mill.



One of the many important features of the Traylor HB Jaw Crusher is the Traylor developed curved jaw plates employing the principal of the famous curved setting which have proved so successful in Traylor crushing machinery. The forged

steel swing jaw shaft and the patented swing shaft suspension are two more of the features built into Traylor Jaw Crushers. For more information, write for Traylor Bulletin No. 5105.



**TRAYLOR ENGINEERING & MFG. CO. 1152 MILL ST., ALLENTOWN, PA.**

Sales Offices: New York — Chicago — San Francisco  
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P.Q.



## YOUR GRADER—

Chances are, you consider a grader a maintenance tool . . . a kind-of "necessary evil." But is it just that?

Think how a grader keeps haul roads in top-speed shape—thus increasing the number of round-trips your haulers can make daily. Or think of the extra working days you gain because ditches, cut by a grader, let water run off faster.

### Objective . . . increased production

The net result of most grader work in mines, quarries, and pits, is higher output . . . increased production. In a sense, the extra tonnage you get—due solely to work of your graders—is really *their* production. It's output you wouldn't get without graders . . . couldn't get without added expense.

So! While your grader may be a "maintenance" tool in function, it is actually a "production" tool in results. That's why you will want to select your graders carefully, on the basis of work-output. You'll want machines that can handle *all* your blade-work *fast* . . . that can help you get the "last ounce" of tonnage with your production equipment.

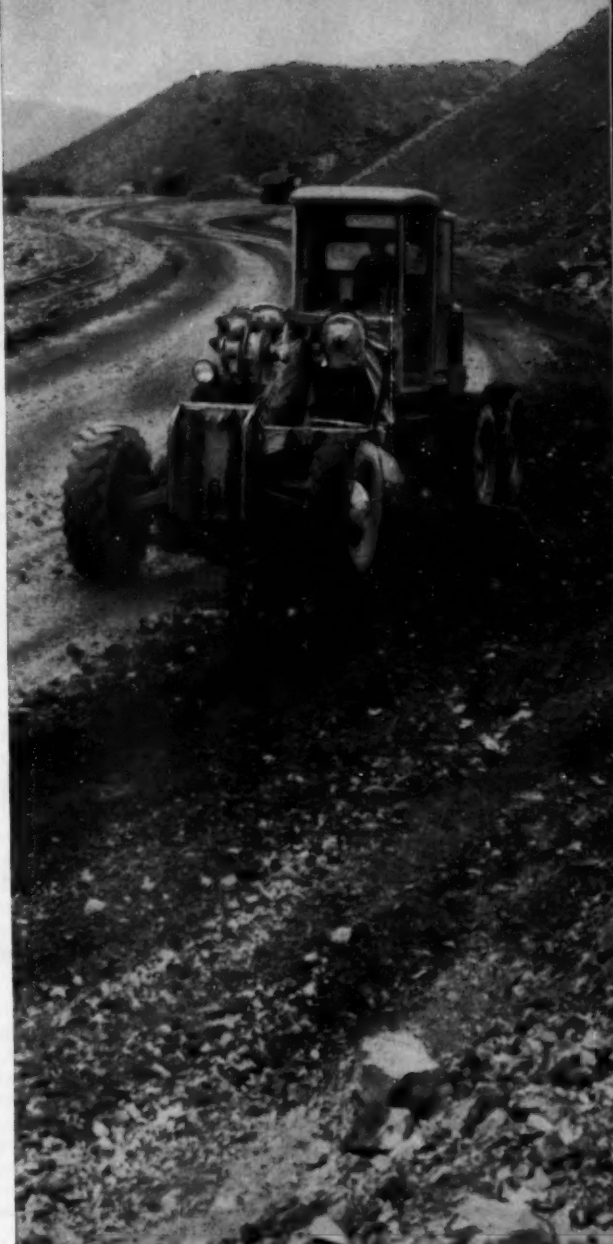
### L-W "660" does more work, faster

You'll find that a big L-W Adams† 660 grader can cut deeper, push more dirt, move it faster than other graders of similar size, price, and power. "660" gives you greater work-output than others—mainly because of its wide selection of power-speed combinations, which let you do more of your work at full engine-power. The L-W grader also provides extra, faster forward and reverse speeds to save you time on traveling, maneuvering, and backing-up for the next cut.

This profit-boosting grader is offered in 2 power options: Standard "660" with 160-hp diesel and constant-mesh transmission, or POWER-Flow® 660 with 190-hp engine and torque converter. Five other L-W Adams model graders—60 to 145 hp—also available.

Call or write for complete information about features that make LeTourneau-Westinghouse machines the most profitable graders you can own.

## PRODUCTION TOOL? ...or OVERHEAD?



†Trademark G-1884-MQ-Ir

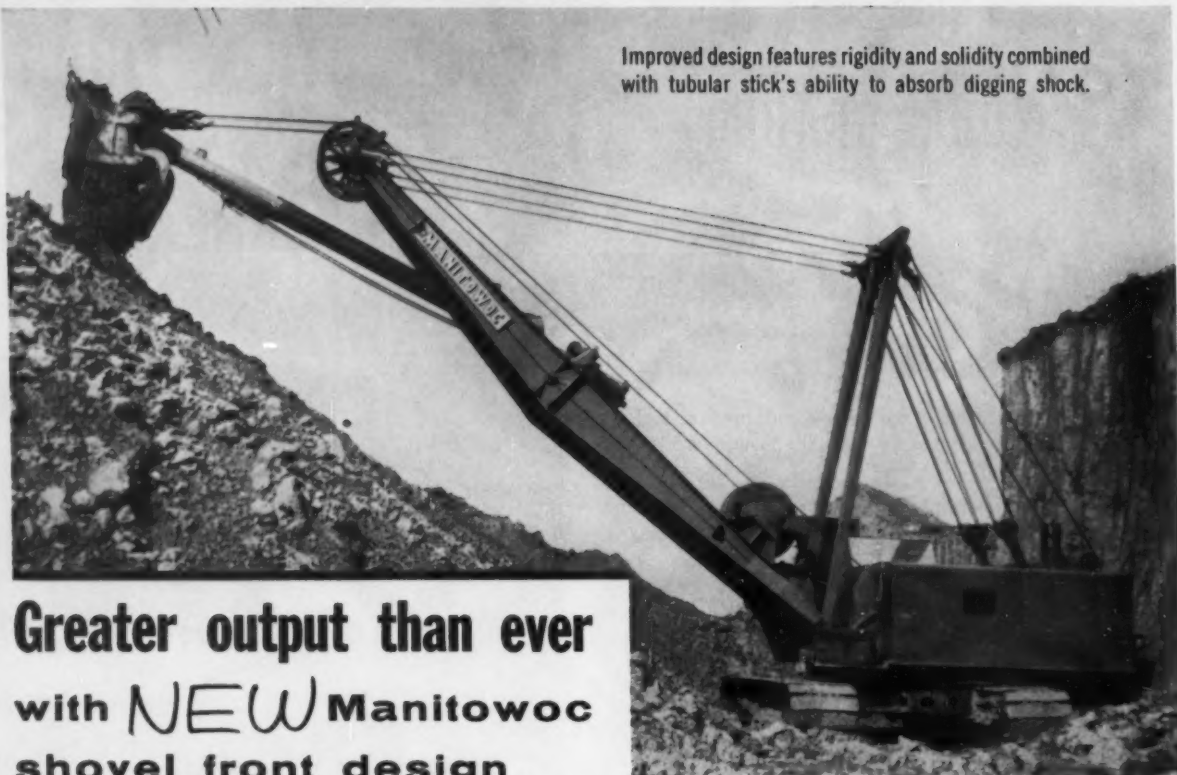


**LETourneau-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS**

*A Subsidiary of Westinghouse Air Brake Company*

**Where quality is a habit**

Improved design features rigidity and solidity combined with tubular stick's ability to absorb digging shock.



## Greater output than ever with **NEW** Manitowoc shovel front design

- Better digging action
- Direct hoist power
- Absorbs impact shock
- 50% less cable wear

Now the powerful Manitowoc Model 4500 5½-yd. shovel combines an improved method of dipper suspension and direct application of hoist power to give you faster and better digging action . . . increased production . . . longer machine life.

**DIRECT HOIST POWER.** Two short cables, powered by a double-drum spool mounted on the boom base, are separately reeved through each boom point sheave and are attached directly to swivel sockets at the outside corners of the dipper bail. Power transmission is simple and direct, eliminating long cables and frequent sharp bends. Cuts your maintenance costs and down time.

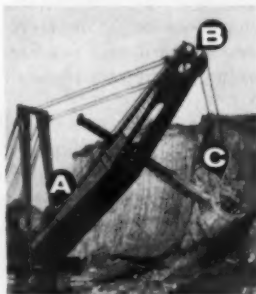
**STABLE DIPPER SUSPENSION.** With hoist cables attached to each side of the bail, and the bail block eliminated, you get widespread support of the dipper, added rigidity and stability in tough digging . . . yet you retain the shock absorbing features, resiliency and flexibility that tubular dipper stick design provides. You can still handle a rock too big to go through the dipper—simply lift it to the top of the spoil pile and as soon as you put slack in

the hoist cables, the dipper will turn sideways and "spill" the rock.

In addition, you get better bucket penetration and loading with less spillage because all linkages are in line, and the bucket is more stable in every phase of the crowd, hoist and swing cycles.

To get complete information on the all-new Manitowoc shovel front end design, ask your distributor for a copy of Form No. 23-58 or write to Manitowoc Engineering Corp. for full details.

**Here's How It Works:** Hoist power is transmitted by heavy cable from the shovel main front drum over the center of a large "Secondary" hoist drum (A) mounted at the base of the boom. Cables are rigged from each of the spools on the secondary hoist over the boom point sheaves (B) and tied directly to heavy duty swivel sockets on each side of the bail (C). The hoist power flow is direct and simple, without sharp cable bends.



# Manitowoc

## MANITOWOC ENGINEERING CORP.

(A subsidiary of The Manitowoc Company, Inc.)

MANITOWOC, WIS.

SHOVELS 1¼-yd. — 5½-yd. DRAGLINES 1¼-yd. — 6-yd. CRANES 25-ton — 100-ton

Tournapull Rear-Dumps unload waste sandstone overburden stripped from iron deposits, owned by HADIR, Rumelange, Luxembourg. Front-wheel drive keeps power and traction on solid ground, well ahead of rear wheels, when dumping over high banks. "Our operators prefer these machines to any other," says M. Nouviaire, mine manager at Hutberg.

At Luxembourg iron mine-

At this Luxembourg mine, C Tournapull Rear-Dumps haul loads of sandstone overburden averaging 13 metric tons; "B's", about 20 metric tons. Iron ore is hauled out of lower levels of the mine by small railcars. Rubber-tired LeTourneau-Westinghouse equipment is preferred by the operators. They find lubrication and maintenance operations are easy and quick, because Tournapulls are designed to save time and effort in all operations.

Tournapull—Trademark Reg. U.S. Pat. Off. BR-2073-MJ-1m

## HADIR replaces trucks with Tournapulls, increases production, reduces maintenance

**HADIR**, large European steel producer, has made two major changes at its Hutberg, Luxembourg, iron mine. It has broadened its operations to include open cast as well as underground mining. And, during the last several years, the firm has gradually replaced its trucks with LeTourneau-Westinghouse Tournapull Rear-Dumps.

By making these changes, according to HADIR officials, the mine will achieve greater production at comparatively lower cost. Regarding the Rear-Dumps, mine manager M. Nouviaire reports that

"they have reduced maintenance costs and produce more."

### 6000 tons per day

Production records of the 8 LeTourneau-Westinghouse machines at the mine confirm M. Nouviaire's report. Loaded by two 2.6 m<sup>3</sup> (3½-yd<sup>3</sup>) shovels, the Rear-Dumps move 6,000 metric tons of overburden per 15-hour day. This excellent production is averaged on round trips 1,600 meters (5,250 feet) long, with 5% grades over half of the haul distance, and on soft roads that become very slippery when wet.

Two of HADIR's Tournapulls are Model "B's" with 31¾ metric ton capacities; six are Model "C's", able to carry 20 metric tons. Tournapull Rear-Dumps are also built in a third size, the Model "D", with 10 metric ton capacity.

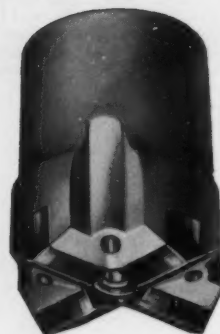
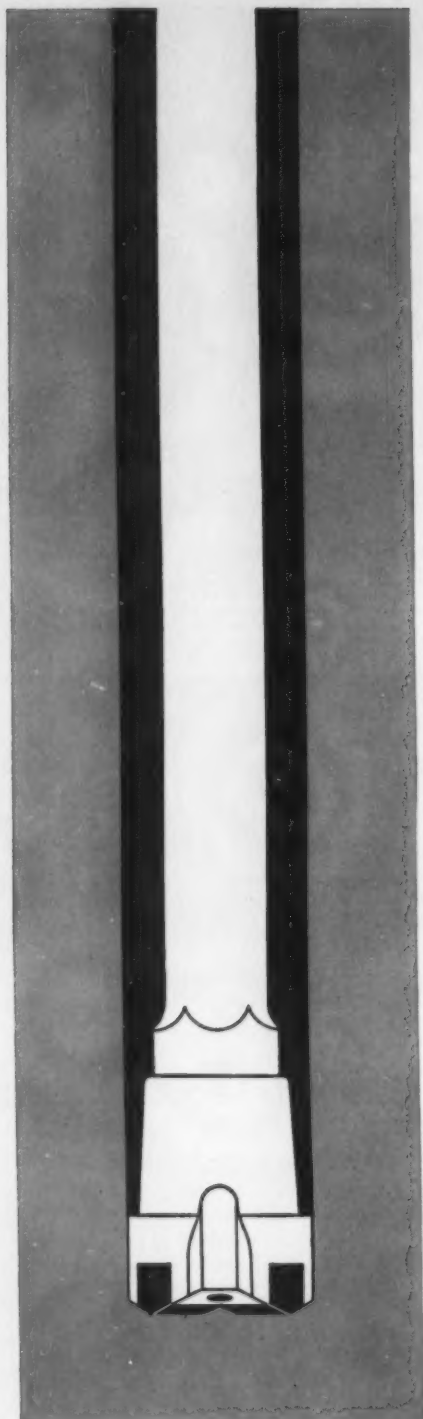
On the biggest mine and quarry operations all over the world, you will see fast, efficient LeTourneau-Westinghouse equipment at work. The world-wide network of LeTourneau-Westinghouse Distributor assures users of dependable repair and parts service. Complete information will be mailed to you promptly upon request.



**LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS**

**A Subsidiary of Westinghouse Air Brake Company**

**Where quality is a habit**



## There's More Footage and Greater Economy in a Joy TC Bit

Here's why . . . Joy bit blanks are precision machined from a fine alloy steel, and a controlled heat treating process adds strength to give rugged service and long life. The carbide insert, a special grade selected for its extra footage-producing ability, is brazed to

the bit blank by an exclusive process. This provides a super tough bond between the carbide and the bit blank—there's no lost time due to lost carbides.

These features, plus the excellent chipway design that provides maximum hole cleaning ability, keep Joy bits drilling longer. You get more hole per bit . . . more hole per shift . . . more production.

For proof of performance, contact your Joy representative. He will be glad to demonstrate Joy Tungsten Carbide Bits.

### YOU'LL FIND YOUR BIT SIZE IN THIS CHART

SHOULDER DRIVE	BOTTOM DRIVE	TAPER SOCKET
1½"	*2½"	1¼"
1¾"	*2¾"	1½"
1¾"	*3"	1½"
1¾"	*3¼"	1½"
2"	*3½"	1¾"
2¼"	*4"	
2¼"	*4½"	
2½"	*5"	
2½"	†4"	
2½"	†4½"	
3"	†5½"	
*3½"	†6"	
*4"		
*4½"		

NOTE: \* x-type.  
† Rose design  
Others are cross  
type.

Write for Bulletin 295-8



EQUIPMENT FOR MINING...FOR ALL INDUSTRY



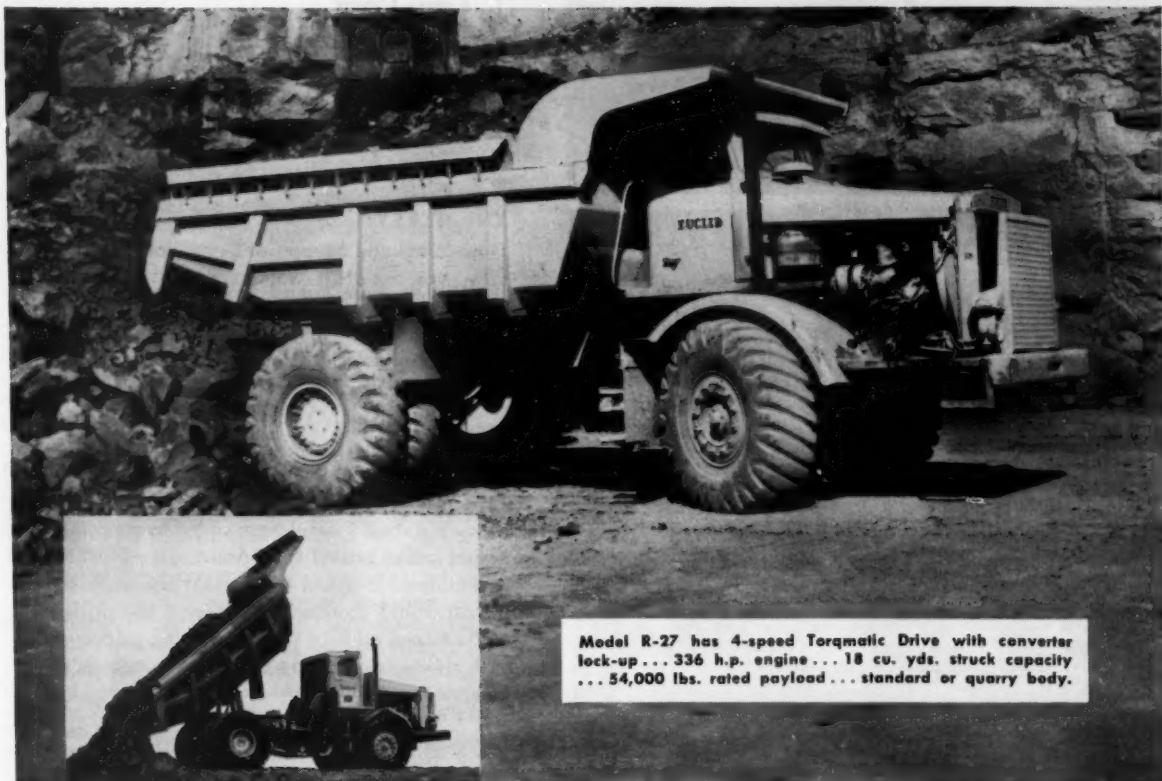
WSW M-7610-399

# JOY

Joy Manufacturing Company  
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company  
(Canada) Limited, Galt, Ontario





Model R-27 has 4-speed Torqmatic Drive with converter lock-up... 336 h.p. engine... 18 cu. yds. struck capacity... 54,000 lbs. rated payload... standard or quarry body.

## Rock Bottom Hauling Costs with Euclid Rear-Dumps

**T**HE simple but rugged design of Rear-Dump "Eucs" has provided cost cutting performance in mines and quarries for over 25 years. This unmatched experience in building dependable off-highway haulers, combined with continuous product improvement and excellent dealer facilities for parts and service, results in high job availability and low maintenance cost.

Euclid's line of rear-dump haulers for mine, quarry and construction work is the most complete in the industry. With standard or quarry bodies, there are models with 10, 15, 18, 22, 27, 40 and 55 ton payload capacities... engines from 128 to 670 total h.p.... 5 and 10-speed transmissions and Torqmatic Drives. For close quarter work there are three over-hung engine models with semi-trailers of 12, 22 and 35 ton capacities.

Have the Euclid dealer in your area give you complete information on the models that fit your requirements. He can show you how "Eucs" cut hauling costs and bring a better return on your investment.

**EUCLID Division of General Motors, Cleveland 17, Ohio**

# What a combination !



## 1. Low Cost

## 2. Excellent fragmentation

## 3. USS Ammonium Nitrate

### THE BLAST:

Utah Lime and Stone Company near Grantsville, got excellent fragmentation from this blast with low-cost USS Ammonium Nitrate. The dense stone in the carboniferous quarry has a hardness of 3.29 Mohs.

### THE MATERIAL:

Three quarts of fuel oil were added to every 50-pound bag of prilled USS Ammonium Nitrate and allowed to stand for at least one week so the oil would thoroughly permeate the prills. A 2 x 8-inch stick of 75% dynamite, initiated with an electric cap was used to detonate each hole.



a.



b.



c.



d.

### HOW IT WAS DONE:

a. Nineteen vertical holes were drilled, 3½ inches in diameter with an average spacing of 10 x 10 feet. The deepest hole was 64 feet and the shallowest, 48.

b. Three horizontal holes, 3½ inches in diameter were drilled to an average depth of 44 feet.

c. A total of 100 to 125 pounds of USS Ammonium Nitrate-fuel-oil mixture was put into each hole: one-third of a sack was poured or blown in first, then the primed detonator, then

the remaining mixture. The charge was stemmed to the surface with limestone cuttings from the drilling operation.

d. A pneumatic loader was used for rapid filling of horizontal holes.

For further information on using safe, low-cost USS Ammonium Nitrate in your blasting operations, write to United States Steel, Coal Chemical Sales, 919 Kearns Building, Salt Lake City, Utah.

*USS is a registered trademark*



## Ammonium Nitrate

# Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

May 1959

## INTERNATIONAL PANORAMA

**ENTERPRISE, UTAH**—Cerro de Pasco Corporation has joined two Utah mining companies—Armet Company and Chief Consolidated Mining Company—in developing the high-grade Holt silver mine.

**LANDER, WYOMING**—Phelps Dodge Corporation's subsidiary, Green Mountain Uranium Company, will start uranium ore production at its Crooks Gap mine in the third quarter of 1959 at a maximum rate of 78,000 annual tons of ore.

**OTTAWA, CANADA**—Canadian production of silver, lead, and zinc increased in 1958 over 1957 figures; silver by 7.9 percent (31,087,681 ounces), lead by 2.0 (185,095 tons), and zinc 2.5 (424,116 tons).

**WASHINGTON, D. C.**—The State Department has announced the next meeting of the United Nations Lead and Zinc Committee is scheduled for New York, New York on April 28.

**GRAND JUNCTION, COLORADO**—The domestic uranium mining industry set an all-time six months high in the last half of 1958 in terms of ore mined and milled, and concentrate produced. Ore milled totalled 3,011,000 tons to produce 6,651 tons of yellow cake concentrate.

**SALISBURY, SOUTHERN RHODESIA**—A new copper smelter and refinery will be built to treat copper concentrates from Southern Rhodesian mines. Messina Transvaal Development Company and M. T. D. Mangula Limited are financing the new smelter.

**NKANA, NORTHERN RHODESIA**—Production of copper in the Rhodesian Copperbelt has reached an all time monthly high of 50,000 tons with the reopening of Bancroft Copper Mines Limited and regular output from five other companies.

**PARANARIMBO, SURINAM**—The German firm of Friedrich Krupp has negotiated an iron ore prospecting arrangement with the Surinam government.

**BOSS, MISSOURI**—The joint iron ore exploration project of American Zinc, Lead and Smelting Company and Granite City Steel Company has located promising copper showings by deep diamond drilling. Iron mineralization has been found in all holes drilled to date.

**STEEP ROCK LAKE, CANADA**—Iron ore shipments of 3,000,000 tons are scheduled this year by Steep Rock Iron Mines, Ltd. This is double 1957 output and will include large tonnages of concentrate from the new beneficiation mill.

**BINGHAM CANYON, UTAH**—Utah Mines Division of Kennecott Copper Corporation has lowered its average ore grade target from 0.82 to 0.81 percent copper. With 90,000 daily tons of ore mined, this will cut copper output by 5,800,000 pounds per year.

**SASKATOON, CANADA**—The first trainload of potash ever produced in Canada has been shipped from the Potash Company of America Ltd.'s mine east of here.

**GRANTS, NEW MEXICO**—United States uranium ore reserves totalled 82,500,000 tons with grade of 0.27 percent  $U_3O_8$  on January 1, 1959, according to the AEC. New Mexico's reserves were 54,900,000 tons and Wyoming's 11,500,000.

**RABAT, MOROCCO**—The Moroccan government has purchased 18 percent of the stock of Societe des Mines de Zellidja which is an important lead and zinc producer. St. Joseph Lead Company and Newmont Mining Corporation are important stock holders.

**MEXICO CITY, MEXICO**—Alaska Juneau Gold Mining Company, formerly Alaska's largest gold producer is exploring a gold-silver property at Guzapares.

**KINGMAN, ARIZONA**—Phelps Dodge Corporation is drilling for borax on Goldfield Consolidated Mines Company's Detrital Valley Saline project.

**CAROL LAKE, LABRADOR**—The Iron Ore Company of Canada Ltd. will develop an iron ore mine, build a concentration plant, a town, and a power plant to produce 6,000,000 annual tons of high grade concentrate. Mining will be in the Wabush Lake area southwest of the firm's direct shipping mines at Schefferville.

## South African $U_3O_8$ Sales Average \$11.82 Per Pound

Recent relaxation of security measures by the South African government has permitted uranium producers to release revenue figures from sales of uranium oxide. Although details of individual contracts for uranium production and sales remain secret, some broad cost figures can now be arrived at and further projected as to profits.

All contracts which expire shortly after 1966, at the latest, are known to provide a purchase price related to cost of production for each mine. The price formula covers milling costs, repayment of uranium loans plus interest, and a profit with a bonus incentive to cut costs. Mining cost is excluded. In 1958, 12,491,337 pounds of  $U_3O_8$  were produced. Exports were valued at £52,612,263. Assuming that all product was exported, it then had an average value of \$11.82 per pound. If the selling price had been \$8.40 a pound (closer to United States figures), the mines would have had only \$3.64 a ton for mining based on 1958 costs and sales. However, value of gold recovered from ore and tailing would pay this mining cost. The important thing is that some mines would be squeezed out at the \$8.40 price and that not all South African uranium is low cost.

## \$1,400,000 Leaching Plant Expansion Set By Chino

Chino Mines Division of Kennecott Copper Corporation is planning a \$1,400,000 expansion to its leaching facilities for the waste dumps of the Santa Rita open-pit mine in New Mexico. The project is scheduled for completion by August of 1960.

The expansion will require additional pumping capacity for recirculation of barren solution from precipitation launders and new pipeline distribution systems for returning barren solution and make-up water to the dumps. Additional storage capacity will be provided for surge and make-up water. The proposed new system is expected to increase cement copper production by 50 percent.

The new distribution system will make it possible to cover all dumps with water whereas only about 40 percent of the dumps can be covered under the existing system. The new installation will provide for centralization of equipment and the installation of accurate controls for the pregnant solution entering precipitation cells, the barren solution exit from the cells and on recirculated water. The flow of solution to the dumps will be increased from the present rate of about 4,000 gallons per minute to about 7,500 gallons per minute. Chino Mines Division has been systematically leaching waste dumps which contain up to 0.25 percent copper since June 1939.





10 YEARS AHEAD OF ITS TIME: This is the description many experts have attached to Sweden's new magnetic con-

centrator for iron ore at Kiruna. The plant can treat 4,000 tons per hour in eight pairs of cobbing circuits.

## Automated Quality Control at Kiruna

By AXEL W. KJELGAARD

The world's largest underground iron ore mine—Kiruna—in northern Sweden will mine, primary crush underground, and hoist 16,000,000 annual tons of magnetite ore within the next few years. This will be the culmination of a 10-year program undertaken by Luossavaara-Kiirunavaara Aktiebolag to convert from open-pit to underground mining, more than doubling tonnage.

In two earlier MINING WORLD articles, I have described "How Kiruna Mining Goes Underground Using Transverse Sub Level Caving" in the September 1958 issue, and "How Kiruna Crushes and Hoists 4,000 Tons Per Hour" in the December 1958 issue.

Actually the ore dressing principle is simple: screen sizing of ore into five sizes, followed by magnetic concentration of each. The ore loading, sampling, and shipping methods, however, are complicated by the following conditions: five grades of ore are shipped; the largest Swedish rail-

road car has a capacity of only 43 tons; and railroad cars can either be loaded directly into ships or stockpiled. Automation and business machine accounting methods developed at Kiruna, which have largely solved these problems, are detailed in this article.

### Magnetic Milling

Ore, crushed to minus-4-inches, is hoisted in one of eight-in-line shafts by Koepe hoists and discharged directly into one of eight 1,000-ton ore bins. Each bin is built right into the hoist tower, as is the concentration mill. Each shaft has its own hoist, bin, concentration unit, and concentrate bin.

The combination shaft tower-hoist-mill building is 375 feet long, 170 feet high, and 96 feet wide. Concentrate is loaded directly into railroad cars in a tunnel driven under the building.

Each crude ore bin has three draw points at the bottom and mill side. Under each, a 32-inch by 8-foot vibrating feeder is placed. The feeder, consisting of a feed plate supported by a steel frame, is supported on the bin end by a number of springs resting on a wooden beam. This beam is

fastened to the bin's concrete bottom by a steel structure. The wood has proven a cheap and efficient vibration absorber. The opposite or discharge end of the feeder hangs freely in a steel yoke, with two connecting links consisting of a combination of steel springs and rubber discs to absorb vibrations. The slope of the feeder can be easily changed by raising or lowering the yoke. By so doing, the rate of feed is regulated. This simple control method has proven quite satisfactory. The vibrating mechanism is powered by a 1,420-revolutions-per-minute electric motor, with adjustable unbalanced weights mounted on the ends of the motor-driven shaft. This unit is mounted in a steel tube connecting the feeder frame sides under the feeder plate.

The center feeder is for so-called "direct shipping ore"; that is, for ore which does not need to be concentrated. This ore is fed to a vertical, cylindrical chute made of ¾-inch-thick rubber to form a slightly tapered hollow cylinder 24 inches in top diameter and 5 feet long. Several lengths are telescoped together to form each chute. These chutes convey the high-grade ore directly to the large storage bins. They have proven to be highly

Mr. Kjellaard, former Chief Mechanical Engineer for Luossavaara-Kiirunavaara Aktiebolag, is now a consulting engineer with offices at Becksjudarvagen 35, Nacka, Sweden.



abrasion resistant and eliminate much noise.

The two other feeders are for ore to be cobbled. Each has a feed rate from 250 to 300 metric tons per hour to three, 4- by 10-foot screens in series. The first two are double-decked with the top deck having 1-inch-diameter round openings and a lower deck with  $\frac{1}{8}$ - and  $\frac{1}{16}$ -inch slots, respectively. These two screens produce three ore sizes: minus- $\frac{1}{8}$ -inch; plus- $\frac{1}{8}$ , minus- $\frac{1}{16}$ ; and plus- $\frac{1}{16}$ , minus- $\frac{1}{8}$ . Oversize from these screens goes to the third screen, single-deck, with 2-inch-diameter round holes. Two fractions, plus- $\frac{1}{8}$ , minus 2-inch, and plus-2, minus-4-inch, are produced. Each fraction drops to a separate magnetic separator or cobbler.

### Wet Screening, Dry Cobbling

The reason screening is used as a means of distributing the ore to the cobbles is that a magnetic cobbler is more effective with classified material. The fraction limits have been established so that, with average screen analysis, the load on the cobbles will be so distributed that the same width of each gives the same relative load; that is, a layer thickness less than the smaller grain size.

It will be noted that the screen mounting is special, compared with a normal gravel plant with five size fractions. There are two reasons for this. First, to make the screens easily accessible for the overhead crane, in case of major repair on a screen; and second to get material spread out so that the cobbles can be easily supervised, checked, and eventually adjusted.

The first feature, however, at this point in the plant is that wet screening is tried ahead of the dry cobbles. The old practice was that the minus- $\frac{1}{8}$ -inch fraction is not cobbled, but sent directly to the ore bins because dry cobbles raise the iron content relatively little with high iron loss in the tailing.

Wet screening is done so that on the first 3 feet of the first screen high pressure water to an amount of 110 tons an hour is sprayed on the ore, thus beating off all fines from the coarser ore. The balance of the screen is then used as dewatering screen, with the effect that anything coarser than  $\frac{1}{8}$ -inch will be relatively dry, and,

in fact, often drier than the feed. Tests have shown that the different fractions could be expected to have the water percentage stated in Table No. I.

The fines go to a wet separator which, for this fraction, is much more effective than a dry cobbler.

Careful tests showed that the difference between the conventional dry cobbling and the described method could be expected to improve the iron recovery considerably. In Table No. II the test result is given for a sample of ore, concentrate, and tailing. It shows clearly that the concentrate is higher and the tailing lower in iron with wet screening. If the table is recalculated to 100 tons of metallic iron in concentrate, one sees a clearer picture of the considerable economic gain the method involves. Details are in Table No. III.

When screen types were being selected, tests were carried out with five different makes and four different types. The decisive factors were simplicity, maintenance costs, and vibration transferred to the foundations. As a result of the tests, the German manufactured Wedag "Zwei-Massen Schwingsiebe" was selected.

The screen decks have round holes for the  $\frac{1}{8}$ - and 2-inch fractions and long slots for the  $\frac{1}{16}$ - and  $\frac{1}{8}$ -inch fractions. The first-mentioned deck has, furthermore, a top cover of  $\frac{1}{8}$ -inch wearing rubber, which has been glued to the steel. This not only gives excellent wearing properties, but the noise is considerably reduced.

### Permanent Magnet Cobblers

The plus- $\frac{1}{8}$ -inch fractions fall from the screens to magnetic drum cobbles 24 inches in diameter and 40 inches long for the three smallest fractions. The drums are 30 inches in diameter and 32 long for the plus-2-inch fractions.

All magnets are permanent Alnico. The initial units were built by the Dings Magnetic Separator Company, Milwaukee, Wisconsin; the second group were built under Dings license by Morgardshammars Mek. Verkstad.



LOWER SIDE of car loading chutes are equipped with counter balance system.

Two drums driven by variable speed motors operate in tandem with a small vibrating feeder in front of the top drum. This turns with a considerably higher speed than the lower drum, the intention being that it shall pull out the "cream" of the ore. Tailing from it is to be retreated on the lower drum operating at normal speed. The reason for this is that the

Table No. III  
Dry Screening Versus Wet Screening at Kiruna in Terms of Tonnage and Grade of Concentrates

Screening	Tons Feed	Tons Concentrate	Tons Iron
Dry	132	103	56.7
Wet	132	100	58.2

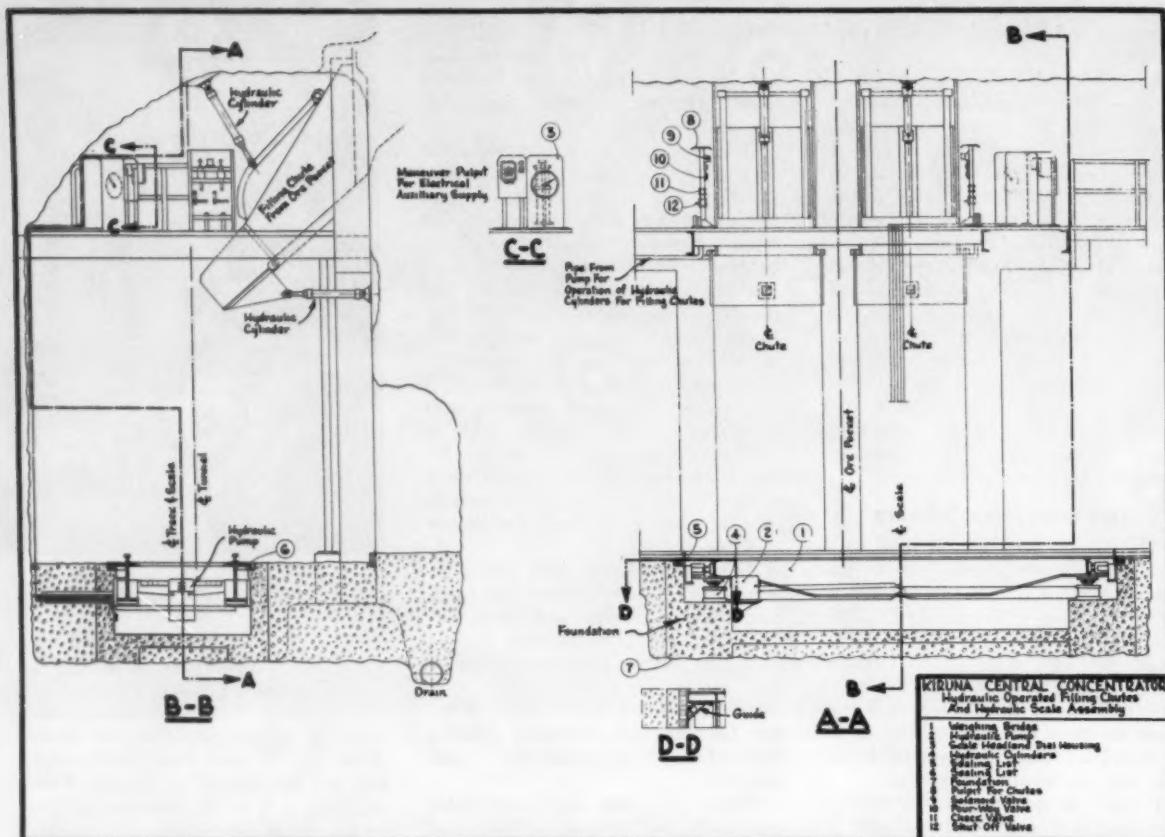
feed contains only about 25 percent gangue; by operating as described, the width of the drums could be considerably reduced. The drums have operated with good results, and there are tests which indicate that the results are better than on the previous electromagnetic separators. Only the coarsest cobbler seems not to work quite satisfactorily, because some of the ore lumps bounce on the lower drum and fall into the tailing. Tests

Table No. II  
Grade and Tonnage of Concentrate and Tailing for Wet and Dry Screening of Four Sizes of Kiruna Ore

Size in Inches	Feed		Dry Screening				Wet Screening			
	Weight Percent	Iron Percent	Concentrate Weight Percent	Concentrate Iron Percent	Tailing Weight Percent	Tailing Iron Percent	Concentrate Weight Percent	Concentrate Iron Percent	Tailing Weight Percent	Tailing Iron Percent
0-1/8	20	45.2	15.6	52.2	4.4	20.6	14.3	61.7	5.7	5.2
1/8-5/16	10	45.0	17.6	53.6	2.4	14.6	7.5	58.3	2.5	5.8
5/16-7/8	20	44.0	15.9	53.2	4.1	10.5	14.8	57.6	5.2	6.7
7/8-2	25	46.1	19.5	55.8	5.4	11.8	19.9	55.8	5.1	7.6
2-4	25	47.6	19.3	58.2	5.7	12.2	19.5	58.6	5.5	9.6
Totals	100	45.8	78.0	55.1	22.0	13.7	76.0	58.2	24.0	7.1

Table No. I  
Water Content of Four Sizes of Wet Screened Ore at Kiruna

Size in Inches	Percent Water
1/8 to 5/16	2.0 to 2.5
5/16 to 7/8	0.9 to 1.0
7/8 to 2.0	0.5 to 0.6
2.0 to 4.0	Less than 0.5



Details of Car Loading Station and Weighing Bridge

will be carried out to combine it with a short feeder belt wrapped around the drum, and a small tail-pulley.

The field strength, of course, is important but to what extent cannot yet be said. For instance, there are results which indicate that, if the strength on the upper drum for fraction,  $\frac{1}{2}$  to  $\frac{3}{4}$  inch is lowered from 450 gauss to 350 (measured at 1 inch distance from the poles), the results are improved.

From the cobbles the concentrate falls to the large storage bins, each of which contains about 8,000 tons, while the tailing drops to a number of conveyor belts, one for each fraction, which unload into small intermediate concrete bunkers at the end of the concentrator building. Under each of these bunkers two small vibrating feeders are mounted, feeding either to a 24- or a 48-inch belt. The smaller belt takes one fraction at a time to a concrete silo, three of which have been built close to the road connecting the concentrator with the community. This material is used for local road building material. The main bulk of tailing rock is fed to the 48-inch belt, which conveys it to the tailing pile.

As mentioned above, the minus- $\frac{1}{2}$ -

inch fraction will probably be treated wet. In that case, the slurry containing 60 to 65 percent moisture is to be fed to tandem wet drum separators with the dimensions 24 inch diameter and 32 inch width. The separators are of a similar design to the well-known Sydvaranger separator (Norway). The concentrate from the first separator is retreated in the second, and the final concentrate, which by now contains 25 to 30 percent water, falls to a specially built vacuum filter. It had been developed in Malmberget by Mr. Bengt Fagerberg and was built and delivered by Sala Maskinfabriks AB. The invention is characterized by a special four-pole magnet which has been built into the vacuum filter, which is of the submerged tank type. The magnets are in the lower part of the drum and placed at the ascending side. They attract the magnetite while under water and keep it fixed on the first part of the rising section, with the result that the capacity is increased and the moisture content decreased. The 80-inch-diameter by 32-inch-wide filter has a capacity of 60 tons per hour of cake with less than 7.0 percent water. The dewatered concentrate falls through a chute to

the ore bin, where it mixes with the other fractions.

#### Problems of Wet Separation

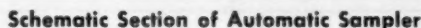
The most difficult point with the wet separation at Kiruna is the de-watering of the tailing. The total water consumption at the screens will be on the order of 8,000 gallons per minute which is much more than the natural inflow to the underground mine. The neighboring lake of Luos-saajärvi, 1,200 yards away, cannot be used as a water source because Kiruna's drinking water, already in short supply, is taken from the lake. A large tailing pond is impractical because of high pumping costs and the danger of contaminating the lake.

As a consequence, it was found desirable to recover as much water as possible, with equipment mounted inside the concentrator building. Two different ways have been tried, each on one section.

In the first case, the tailing from the wet drums was led to a screw classifier, which took out the coarser particles with approximately 14 to 15 percent moisture. The overflow containing the fines, was pumped to two batteries of four, 14-inch hydroclones.

Furthermore, and economically more important, the wet separators have not given the results the tests indicated. The tailing from them, expected to contain 6 to 7 percent iron, is varying considerably from day to day, probably because the ore from the underground mine contains more breccia than expected. A team lead by C. B. Berglund and B. Fagerberg is now working on the problem, and one of the solutions which has been suggested is shown in the flowsheet. The intention is to reseparator the

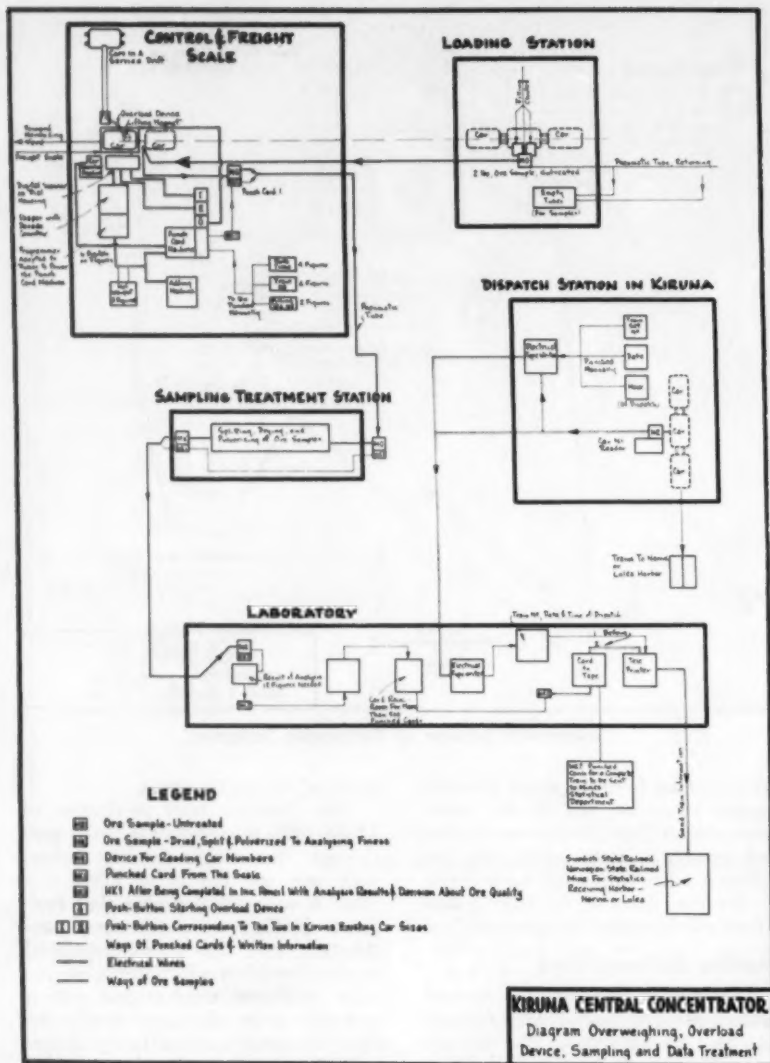
1. Double-drum magnetic separator.
2. Screw classifier
3. Single-drum magnetic separator.
4. Pump.
5. Dewatering table.
6. Dorr thickener, 6.0 meter diameter.



For many years, attempts were made to overcome this obstacle by placing the cars on scales under each chute. The scales were the normal balance type, but experience showed that they could not stand up to the rough handling and the severe climate

Many difficulties were encountered and overcome during tests in 1958. It was proved that, with skilled operators, a 30-car train could be loaded at a speed of 15 seconds per car as the train passed slowly under the chutes.





**Data Processing Center Accumulates Information for Grade Control and Car Dispatching Problems**

Cars had a mean load deviation of about 300 kilos or less than one percent, corresponding to a theoretical loading capacity of about 8,500 tons per hour.

The next step in the development which is still under preparation is to make the filling chutes semi-automatically operated. This will be done in the following simple way: The operator opens the chutes as usual and will then stand by. When the weight has raised to a certain amount under the final one, the scale will send an electric impulse to a solenoid operated valve controlling the chutes' hydraulic cylinders. To make the loading fully automatic is perfectly possible.

#### Train Loading and Control

It has been reported before how the Kiruna ore varies in phosphorus

content so that every car which is dispatched to the shipping harbor must be sampled, the sample analyzed, and the car classified as to ore type.

Here is a description of how each car is sampled and the new system under development to correlate all facts about each car. By this new system the following data about each car of ore will reach the shipping harbor several hours before the car of ore reaches the harbor. Advice to the harbor with a duplicate set of data for the mine includes the train number, railroad car numbers, number of cars in train, and net weight and analysis of ore in each car.

The accompanying diagram shows equipment necessary for the system.

A train arrives at one of the eight loading stations. The locomotive engi-

neer at front end has a punch-card, punched with a mark corresponding to the number of the loading station to which he has instruction to go. He delivers this card to the filling chute operator, who inserts it in a slot in the hydraulic system, where it acts as a key, so that no mistake as to filling station can take place.

The train then moves slowly forward. As the first car starts under the chute, the operator opens it. He then stands by and does nothing except in case an underload is feared. Then he can manually adjust, but normally the hydraulic scale will take care of the procedure and close the chute when the correct weight is obtained. When the next car approaches within reach of the chute, the operator again manually opens the chute, and this procedure is repeated car by car.

During the few seconds it takes to fill the car a sample is taken automatically. The sample contains only minus- $\frac{1}{2}$  and plus- $\frac{1}{2}$ -inch ore and concentrate. The sample is taken as follows: In the lower part of the moving chute lip, which is 48 inches wide, a small fixed-bar grizzly is inserted. See diagram for details. The minus- $\frac{1}{2}$ -inch fines go through this grizzly and drop on a vibrating screen which passes the minus- $\frac{1}{2}$ -inch fraction. This fraction falls into the sampling tube which has a capacity of about two pounds of fine sample. The sampling operator, standing under the chute, takes off the tube and places it on a shelf of the car. He then puts an empty tube on the chute for the next car.

The train is now moved one car ahead for loading the next car. As the train moves the cars pass over a Toledo scale where the weight is taken. This scale is positioned so that on an average the first car in train is being weighed while the twelfth car in the 32-car-long train is being loaded.

Two men operate the ore scale station. When a car enters the scale, the scale operator, who beforehand has inserted a punch card in a punch card machine, checks whether the car is overloaded. When overloaded he pushes the button  $\bar{O}$ , which: (a) stops the train, and (b) starts the overload device. This consists of a fully automatic lifting magnet, which dips into the car, takes an ore load of 300 to 400 kilos, lifts, swings, lowers, and unloads it to a conveyor belt running transversal to the loading tunnel, and unloads in cars in a parallel tunnel used for servicing the mine hoists. The magnet automatically returns and repeats the operation, until the scale operator can see that the overload has been taken away. He then pushes the button I or II, corresponding to whether it is a 37-ton (net) or 42-ton



car, which: (a) gives a green light to the train to proceed; (b) punches the date, the time, the train number, the car number, the loading station number, and the net weight of the ore (as the tare differs, a subtractor, based on the statistical mean of the cars' tares, has been placed in the scale); and (c) writes the weight on a slip in a normal electric adding machine (this is for company record and payment). The day, train number, and loading station number are fed to the machine by hand by the scale operator. In case of no overload, which can be expected for more than 99 percent of the cars, he simply pushes the button I or II.

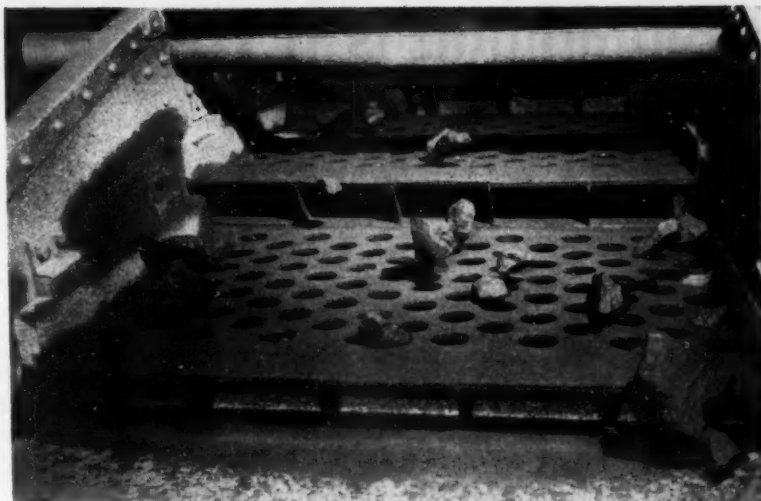
Automatic registration of the railroad car numbers should be explained further. Many different methods have been discussed about how to automatically read, register, and tabulate the car numbers, and have had to be discarded because of the climate, differences in the cars etc. The solution believed to solve the problem has been worked out by L.K.B. Produkter in Stockholm.

#### Automatic Car Number Reading

It is electronic equipment for automatic registering of car numbers. It forms a vital part of the elaborate system for automatic control of iron-ore handling in the large mining district in the northern part of Sweden. For identification each car is equipped with a sturdy code plate carrying a six-digit number in decimal binary code formed by blocks of iron protruding from a main plate, all cast in one solid piece. The space between the blocks is filled with aluminum, insuring a plane, smooth surface. The plate is fastened to one of the roller bearing boxes of the car.

At the reading station an inductive detector unit indicates when the code plate passing by has reached a suitable position for reading. A strong current pulse is then fed to a series of special differential transformers. The code number of the plate is immediately transferred to a ferrite core memory. By means of a shift register and a special program unit the data are fed to the punch card machine.

The reading process in principle is largely independent of the speed by which the code plate is passing by. So far the equipment has been tested at speeds from a mere creeping up to 18 miles per hour. Actually, the maximum speed was set by the recorder used. The reading distance is nominally 10 to 12 millimeters. With the exception of the pulsing unit, the equipment is completely transistorized. Full-scale experimental equipment has been operated out of doors for months. Actual field tests are now



RUBBER COVERING on top of screen has an estimated life of 700,000 tons of ore. The covering is  $\frac{1}{2}$ -inch thick and is bonded and bolted to the steel plate.

underway.

The machines which punch the car cards are simultaneously writing out the punch code on top of the card in normal letters and figures for the sake of human identification—if errors must be sought.

When the punched card is released from the machine, the second man at the station takes it, attaches it to the sample tube, which he has taken off the ore car, and dispatches it via a pneumatic tube to the sample preparation plant. There it is dried, pulverized, and split down to a 100-gram sample which, followed by the punched card as identification, is sent within five minutes by another pneumatic system to the assay laboratory. In this department, Mr. Fernlund calculates that his organization can have the analysis and quality decision ready in less than 15 minutes. The result is written by the analyst in ink on top of the punched card corresponding to the sample.

#### All Results on One Card

The punched card is then delivered to a punch card operator, who translates the laboratory's results into a punched code, and the card is placed on a rack arranged by car number.

Now in this rack there are up to 500 punched cards, all with complete information written clearly on the top of the card.

In the meantime, the ore cars have been moved toward the marshalling yard. At the railroad station they are assembled into trains of about 60 cars under the supervision of the state railroad personnel for dispatch to Narvik or Luleå, the shipping harbors.

When a train is started, the supervisor types the train number, date,

and hour of dispatch on an electric typewriter. As the train leaves the station, a car number reader, identical to the one at the freight scale, records every car and sends number to the typewriter, thus giving the railroad the train list. All this information is directly duplicated on another electrical typewriter placed beside the rack with the informative punched card.

The punched card machine operator can now take the list of cars actually in the train and remove the cards from the rack corresponding to the cars. Automatic sorting and elimination of cards did not prove practical at this point. After checking the train list (received from railroad company) he feeds the punched cards into a card-to-tape machine which teletypes a complete description of each car in the train to the shipping harbor. Thus, on arrival at the harbor, the train is immediately sent to either direct ship loading or stockpiling.

Finally, the operator at the punched card rack collects the cards, wraps the train list around them, and sends the package to the statistical department for final treatment.

This is the story of concentration and shipping procedures at Kiruna. Much has been learned, and many improvements in equipment and methods have been made. However, the entire staff knows that much more progress is possible. To that end the Research and Development group is continually seeking better designs and new plans. The operating group is quick to make improvements where indicated by actual production. Kiruna continues to expand and continues to improve its methods.

THE END.

# Columbium: Is It Headed for a Boom?

Columbium has suddenly vaulted into the limelight in industry's search for materials meeting more rigid mechanical and chemical specifications. The opinions of those who should know tend to be highly optimistic about the future consumption of ultrapure metal. The conservatives among this group say that production of columbium will be measured in thousands of tons annually, perhaps within five years. The extremists see a monthly output between 1,000 and 4,000 tons per month by 1968 when they say the price per pound will be in the \$4 to \$6 range. The current quotation for columbium is now \$55 to \$85 per pound.

Where will this growth take place? These people are speaking of an industry based on production of pure ingots and mill products. They are pointing to potential use of columbium products made from sheet, tube, or foil; they are referring to applications of columbium-base alloys, and perhaps other alloys such as 90 percent uranium, 10 percent columbium used to clad nuclear fuel elements.

They are not speaking of the already established output and con-

sumption of ferrocolumbium where most of last year's approximate 1,000-ton production of columbium-tantalum was used. Ferrocolumbium (50 to 60 percent columbium) is used as an alloy additive for making stainless steels. It is processed by electric furnace and this application should also show expansion in the years ahead.

Until just recently, development of markets for high-purity columbium was limited by the sky high prices. Now new production techniques hold promise for slashing costs. When the price comes down, proponents of columbium say the metal will attract and capture new markets.

The economic record in the fabrication of the so-called "special" or "wonder" metals has not been a particularly happy one. But columbium's enthusiasts claim that the metal may escape some of the limiting difficulties which have hampered titanium, possibility zirconium. They say that techniques learned at great expense in developing titanium and zirconium will provide a better experience-base for developing uses and in processing columbium.

Columbium, however, still has some

major hurdles to pass. It will be competing with zirconium, tantalum, and stainless steels for markets. All of these products have had a head start in development. Still another major obstacle must be overcome. Oxidation resistance of the metal is poor. The optimistic market predictions for columbium are based on circumventing this problem by perfecting oxidation resistant alloys with columbium as a base.

From what we have been able to learn, don't expect much growth in columbium's market until the price falls to \$15 per pound. This is far below the present price and the predicted price level attainable in 1959 (\$50 per pound). Even at the \$15 level, production of columbium probably won't amount to much more than a semi-works scale, i.e., 20 to 40 tons per month. But if the price drops to the \$4 to \$6 range, then the market for columbium will show amazing growth say the optimists.

Despite these disadvantages, the future for columbium looks promising. Too many responsible officials are forecasting a growth for the metal to dismiss columbium as another flash-in-the-pan.

## The Properties of Columbium Look Attractive

**Strength at high temperatures** is one of the main attributes of columbium. At room temperature, ultimate tensile strength of columbium is about 35,000 pounds-per-square-inch, which is weaker than most ordinary structural materials. Biggest redeeming factor, however, is that the metal retains a high percentage of its strength as temperature goes up. For example, it has been reported that at 2,200°F., the short time tensile strength of columbium is 14,800 pounds-per-square-inch. Tensile elongation is about 15 percent at 2,200°F.

**Creep strength** of unalloyed columbium is about the same as molybdenum in the 1,600 to 2,000°F. range. Work is being done on improving strength of columbium, but data is limited or unavailable. Alloy additions of tantalum, tungsten, and molybdenum strengthen columbium to 64,300, 66,500, and 90,000 pounds-per-square-inch respectively. For nuclear applications, columbium is amply strong. For use in gas turbines, higher strength at temperatures of

2,200°F. would be desirable.

**Extraordinary ductility** of columbium is one of its most outstanding features. The workability of the metal is in a class with gold and silver. The high-purity product of the electron beam furnace does not work to harden beyond about 50,000 pounds-per-square-inch, no matter how extensively it is deformed. The cold fabricability of columbium is excellent. Cold reductions of as much as 98 per-

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Atomic number	41
Atomic weight	92.91
Specific gravity	8.4
Melting point	2,500 °C.
Boiling point	3,300 °C.
Color	Steel-gray
Type of crystal lattice	Body-centered cubic
Linear coefficient of expansion per degree C.	$7.1 \times 10^{-6}$
Electrical resistivity at 20° C., microhms per centimeter	13.1

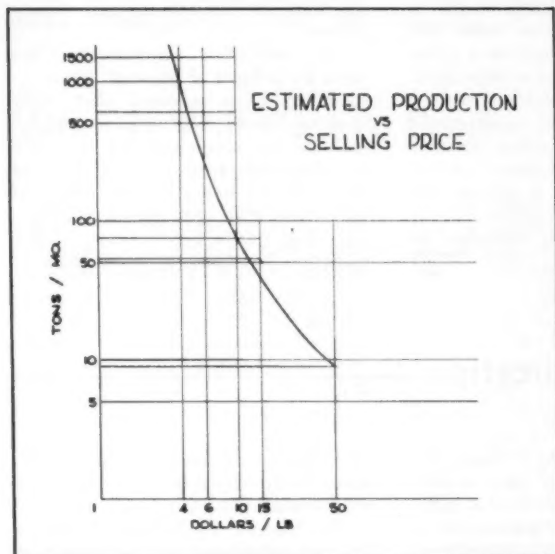
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cent can be performed as a result of the low rate of work hardening. Severe cold-forming operations, such as deep drawing are possible. Hot working has seldom been done, due to amazing cold working property. Hot working, however, may prove useful in fabrication of large ingots. Ductility may be a factor of considerable importance for new applications involving complex shapes that normally have to be made from castings.

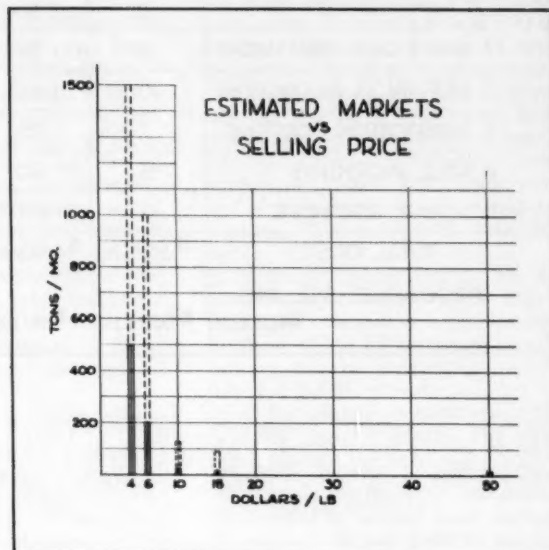
**Low neutron absorption** is a characteristic which makes columbium useful for atomic energy applications. Battelle Memorial Institute reports that conventional structural and corrosion resisting materials absorb neutrons so strongly that the economy of the reactor is decreased. It is partly for this reason that zirconium merited intensive development, and was a bargain even when its cost was higher than at present (now about \$55 to \$80). Zirconium, however, has a serious disadvantage. It is too weak for use at high temperatures, and for high-temperature reactors stronger

## A Strong Growth Pattern Is Indicated

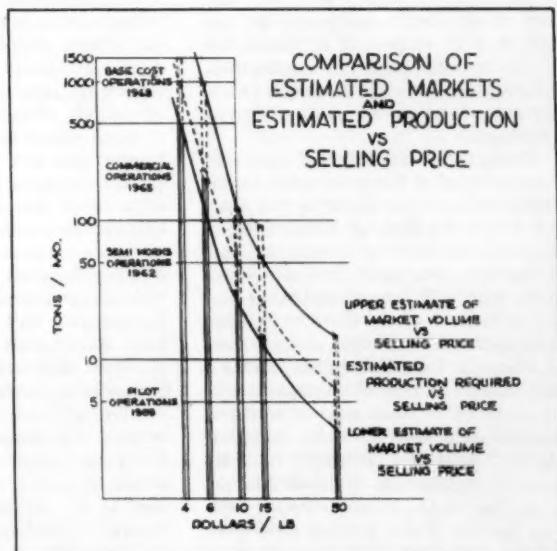
As the selling price goes down, markets will grow about as indicated. Look for big growth at \$4 to \$6 range. Predicted price attainable in 1959: \$50 per pound.



To get a more accurate picture of the future, the supply-demand relationships pictured above are plotted on the same graph. The danger: overexpanded production.



These levels of production will be required in order to achieve the economies necessary to permit reductions in the selling price of columbium.





## Detailed Prediction of Probable Production Costs

OPERATION	COST, \$/LB		
	PRODUCTION LEVEL, TONS/MO		
	5	50	1000
1 ORE & ORE TREATMENT	2	1.50	1.50
2 REFINING & REDUCTION	10	1.60	.90
3 PURIFICATION & CASTING	7	.75	.25
4 MILL WORKING	5	.60	.30
5 SCRAP RECYCLE	6	.45	.25
TOTAL COST	\$30/LB	\$4.90/LB	\$3.20/LB
PROBABLE SELLING PRICE	\$50/LB	\$9/LB	\$4/LB

materials are needed. Columbium looks to be the metal which holds most promise of meeting these requirements. Although the neutron absorption cross section of columbium is about six times that of zirconium, it is less than half that of other high temperature materials. Columbium may find use as a structural material in nuclear reactors and also as a stabilizing alloy agent in some types of nuclear fuel elements.

**Corrosion resistance** in non oxidizing media is good. In aqueous media, resistance to attack is generally good

and almost equal to that of tantalum. Zirconium's corrosion resistance under aqueous conditions, however, is better. Normally the latter would be considered for application unless the price of columbium drops to a point where it might become competitive.

To be useful for cladding reactor fuel, columbium should resist corrosion by the reactor coolant. Reactor coolants include liquid metals, gases, and pressurized water. In sodium and potassium, columbium appears to possess adequate corrosion resistance to temperatures of about 1,250° F. At

1,600° F. there is some doubt as to its corrosion resistance. Behaviour of columbium in gases other than nitrogen and oxygen is little known. In nitrogen, it has been suggested that at 900° F., surface embrittlement does not advance to more than a mill in 1,000 hours. Diffusion of nitrogen is slowed by the fact that an adherent nitride film is formed, limiting the rate of attack.

**Oxidation resistance** of columbium is poor. This constitutes one of its biggest disadvantages. Pure columbium oxidizes badly in air at temperatures above 800° F. This may not be hopeless, however. Above 930° it has been reported that the metal forms a porous scale and oxidizes in direct proportion to the exposure time. The rates of scaling are high compared to iron, nickel, and cobalt-base alloys, but better than molybdenum. Corrosion damage is not limited to the surface. Oxygen dissolves and diffuses in columbium making the metal brittle. Present high-temperature uses of columbium are limited to inert atmospheres.

The oxidation characteristic has been the subject of research. Some researchers have reported that other reactive metals such as titanium, vanadium, and chromium can be added to columbium to produce alloys that are fairly oxidation resistant. Present indications give grounds for optimism regarding future improvement of the oxidation resistance of columbium.

## Where Columbium Will Find Application

Use of pure columbium will fall into three broad categories. It just isn't possible to predict accurately all of the specific potential applications because study and investigation is moving ahead in so many different directions.

**Sheet, tube and foil** will comprise a major market for pure columbium. Applications of the metal in this form will fall in the fields of atomic energy, the chemical industry, electronics, and marine use. The properties of columbium that will attract outlets in the above fields include its low nuclear cross section, its strength at high temperatures in inert atmosphere, and its corrosion resistance. The unique workability of columbium may account for potential new uses involving complex shapes that would ordinarily have to be made by castings. Columbium can be worked into complex shapes and then hardened by surface oxidation and vacuum annealing.

**Columbium-base alloys** may develop into a market of considerable importance. Applications in this category are dependent on perfection of high-temperature, oxidation-resistant alloys rich in columbium. When and if these alloys become available, the largest use will probably be in gas turbine engines. The high price of such alloys will probably restrict gas turbine use to military applications. As prices are scaled down with increasing business volume, use of gas turbines will expand to automobiles, locomotives, and civilian aircraft. At least three major research programs are now underway to develop high-temperature, corrosion-resistant alloys.

**Alloy additive** to other metals such as iron will comprise another market for pure columbium. The only example of such a potential application now is the 90 percent uranium, 10 percent columbium alloy for nuclear fuel elements. If the price of colum-

bium drops substantially, other similar uses should develop in response to price reduction.

The size of all potential markets for pure columbium will be dependent to a large extent on the price of the mill product. The most optimistic forecast we've seen was detailed by Charles d'A. Hunt, manager of the joint venture melting project (electron beam process), Temescal Metallurgical Corporation. He hedges by pointing out that his forecast is based more on historical parallels (titanium, zirconium) than on detailed fact. He also points out that the market for special stainless steels such as Type 347 is about 4,000 tons per month, at a price of about \$1.25 per pound of 1/4-inch sheet. His forecast also assumes that suitable oxidation resistant, high temperature columbium alloys will be developed.

Mr. Hunt thinks that a columbium mill product price of \$50 per pound



will be reached in 1959. At such a price, columbium would be presumably used where there is no competitive material, except possibly tantalum. In atomic energy, said Mr. Hunt, I can see uses for five to 25 tons of columbium per month. How will it be used? Mainly as a structural, cladding, and alloying material in nuclear reactors says Mr. Hunt.

Assuming alloy developments proceed satisfactorily, a market of similar size (5 to 25 tons per month) will exist in military gas turbine uses. . . . In special marine, chemical industry, and electronic uses based on corrosion resistance, a market of two to 10 tons of columbium sheet and tube will exist at \$50 per pound. Total possible use at \$50 per pound adds up to 12 to 60 tons of columbium mill product per month. This is about  $\frac{1}{3}$  the present market for zirconium which is priced at \$15 per pound.

New markets for columbium will appear if the price drops to \$15 per pound. In atomic energy, columbium would present itself as a direct and

economic competitor to zirconium. Use might grow to somewhat between 20 and 100 tons per month, says Mr. Hunt, if an analogy is drawn with the zirconium situation. Military gas turbine engines might come into the market for another 20 to 100 tons of metal at \$15 per pound. The latter mill price, however, will not stimulate much additional demand over the \$50 price for marine, chemical, and electronic uses. Reason; at \$15 per pound columbium would still not be competitive with other less exotic materials. But the lower price would stimulate vastly increased research and investigation involving applications that might result in future markets in response to price reductions below \$15 per pound. Mr. Hunt estimates a total consumption of 50 to 250 tons of columbium per month at \$15 per pound.

At \$10 per pound, marine, chemical, and special uses ought to climb to about 20 to 100 tons of columbium per month. It is doubtful that military or AEC uses would be stimulated by

this new price. Cumulative total use of columbium at \$10 per pound would be about 70 to 350 tons per month according to Mr. Hunt.

At \$6 per pound marine, chemical, and electronic applications of columbium ought to rise to a rate of 100 to 500 tons of metal per month. Of even greater importance is the possible use of columbium-base alloys for automobile gas turbine at this price. It is possible that this field might consume 200 to 1,000 tons of columbium mill product per month. Total cumulative use of columbium at \$6 would be between 370 and 1,800 tons per month.

Should the price drop to \$4 per pound then Mr. Hunt's guess is that the use of columbium might increase by about 400 to 2,000 tons per month. Adding this to consumption established at the \$6 price the industry demand for columbium might reach 800 to 4,000 tons per month. The latter figure is about the same as the present market for the special stainless steels with superior properties.

## What It Will Cost to Produce Columbium

Obviously unit production costs are a function of production rates. An output of mill products grow, costs should decrease assuming that technology shows a normal development. Again we return to Mr. Hunt to get his estimated costs for producing a pure columbium mill product. His forecast: a production level of five tons a month would be necessary in order to achieve a total production cost of \$30 per pound. At 50 tons per month total cost could be slashed to about \$4.90 per pound and if output ever goes to 1,000 tons per month then production costs will be worked down to \$3.20 per pound. The probable selling price at each of these levels will be somewhat higher to allow room for a reasonable profit.

Though he declined to provide a breakdown of his cost figures, we have pulled together the best available information we could find regarding production costs for titanium and zirconium. Then we adjusted the figures to agree with Mr. Hunt's forecast of total production costs. We've also added our own idea of what the probable selling price will be. The figures are set forth in the table.

Production costs logically breakdown into the five principle processing categories shown in the table. Most of the known resources of columbium are of sufficiently low grade that

mining and treatment costs will always remain relatively high on a per pound basis. A production level of five tons a month would provide little chance for volume production whereby mining and beneficiation costs could be reduced much under the current market levels. At present columbium concentrate commands about \$1.00 per pound for 65 percent  $\text{Cb}_2\text{O}_3$ . Since  $\text{Cb}_2\text{O}_3$  contains only about 65 percent metal, the \$2.00 cost at five tons of metal per month doesn't look unreasonable. At a production level of 50 tons of metal per month in a reasonably stable market, mining and concentrating costs might be shaved to \$1.50 per pound.

The cost of reducing and refining columbium is strictly a guess on our part. Mr. Hunt provided us with his estimates for the cost of purification and casting and charges for recycling scrap at the three production levels using the electron beam process. We arbitrarily assumed that reduction of columbium would account for  $\frac{1}{3}$  of the difference between the total of mining, reducing, scrap recycle and Mr. Hunt's estimate of total production costs. Mill working we assumed would account for the remaining  $\frac{1}{3}$ .

The figures presented show several interesting relationships. A simple comparison of Mr. Hunt's estimated markets (demand) against his esti-

mate of the production levels required to attain a certain selling price, indicate that supply of columbium will be tight. Only at the higher production levels will the supply approach the potential markets.

The very same figures, however, could be used to show that there is a real danger of over expansion of producing facilities. Suppose that three major firms enter the field, and suppose that each firm is successful in capturing roughly a third of the market. It would be reasonable to assume that production costs of each of the three firms would be comparable. Based on Mr. Hunt's lower estimates of demand, the size of the market for each price level is considerably lower than the production volume required to meet that price. The upper estimates of demand at each price level are considerably above the minimum production volume required to meet the corresponding selling price. Producers banking on the higher demand levels could be led into a situation of over capacity. In this case the columbium industry would be put under a severe strain similar to the experience of titanium producers right now. The most serious spread between upper and lower market estimates occurs at the higher capacities. It is in this area that technological know how will make or break producers.

THE END

For Smelting . . . . .

## 3 Ways to Use a Fluid Bed Reactor

By SIGMUND L. SMITH and  
FRED L. STUBBS  
University of Arizona  
Tucson, Arizona

At the present time there are several patents and a number of ideas relating to the use of fluidizing reactors for smelting problems. In this article, a few of the patented processes and ideas are reviewed. It should be pointed out that the processes discussed below are not necessarily commercial. They are presented to give an overall picture of the various possibilities or approaches to the use of the fluidizing reactor as a means of smelting ores of some of the common metals.

The term smelting as used in this paper is defined as the charging of solid materials into a furnace under oxidizing, reducing, or neutral conditions at an elevated temperature to produce a liquid or solid metal or metals.

The first process is that of using a reducing media to produce solid metal, sponge iron. Mr. Osborn's patent will be discussed because it has a number of interesting ideas. Other patents have been taken out, particularly by the United States Steel Corporation. A sketch of the Osborn patent is shown. Study the details. Feed consisting of a calcine made from a pyrite concentrate and assaying 68.3 percent iron, or 57 percent  $\text{Fe}_2\text{O}_3$ , and 43 percent  $\text{Fe}_3\text{O}_4$  is mixed with two parts, by weight, of an inert material, generally lime. All material in the size range of minus-20-mesh, plus-150-mesh is preheated in a rotary kiln by the flue gas coming from a heating muffle located inside the reactor. The temperature of the solid feed to the reactor is maintained at about 750° F. The inert material is solely to prevent the sponge iron particles from sticking together when it is formed by the reduction of iron oxide. In general the reducing gas is CO or  $\text{H}_2$  produced from the cracking of methane. However, according to Mr. Osborn's patent if the temperature in the reactor is kept high enough methane gas can be used directly in the reactor as a reducing agent. Temperatures around 1,200° F. will cause methane to decompose giving a sooty deposit of carbon and  $\text{H}_2$ . A temperature of around 1,660° F. is maintained by

using bed gas from the reactor and natural gas, if needed, and burning them in a muffle in the reactor to furnish heat for the endothermic reactions. The various oxides of iron traveling through the reactor are reduced to sponge iron by the methane. Fluidizing gas is natural gas, about 12 cubic feet per pound of iron reduced, and a make up of bed gas to obtain the proper space rate. Recycling part of the bed gas not only forms a fluidizing gas but its presence seems to prevent the cracking of methane and helps maintain a high specific gravity gas compared to a gas consisting of hydrogen and carbon monoxide. The sponge iron is recovered by a magnetic separator. All non-magnetic material is returned to the feed hopper where it is united with a fresh amount of iron calcine.

The magnetic material contains 90 percent iron or 79 percent metallic iron. The bed gas, containing about 6 percent  $\text{CO}_2$ , 28 percent CO, 30 percent  $\text{H}_2$ , 28 percent methane, and 8 percent  $\text{N}_2$ , is taken to a heat exchanger where the gas to be used for fluidizing is preheated. It then passes to a dust collector and scrubber. Part of the bed gas from the gas holder is blended with natural gas to make the fluidizing medium, which, before entering the bottom of the reactor, is preheated by the escaping gas from the reactor.

The other portion of the gas from the holder is used to furnish heat in the reactor for the endothermic reactions that produce sponge iron. This gas, along with any additional natural gas necessary, is burned directly in a muffle located in the reactor. The combustion taking place in the muffle indirectly furnishes heat for the endothermic reactions.

The temperature maintained in the muffle is around 1,900° F. and in the reactor proper the temperature is about 1,600° F. The exit gas from the muffle is discharged into a rotary kiln which is used to preheat the solid material entering the reactor. The kiln thoroughly mixes the calcine containing the iron oxide and the inert material, generally lime, used to prevent sticking of the sponge iron.

The Osborn patent seems to have the two conditions that are necessary for carrying out a sponge iron process. First, means are provided for furnishing a great deal of heat directly to the endothermic reactions. Second,

means are provided for preventing the sponge iron particles from sticking to each other thereby reducing freeze-up problems. The capacity of a sponge iron plant of this nature is directly proportional to the amount of heat supplied.

The second possibility of using a fluidizing reactor for smelting is the reduction of an oxide to produce a metal that volatilizes easily. One of the primary items to overcome is the re-oxidation of the volatile metal back to an oxide, or the reversing of the chemical reaction that produced the metal. An example  $\text{ZnO} + \text{CO} \rightarrow \text{Zn} + \text{CO}_2$ . Any excess of  $\text{CO}_2$ , either from the chemical reaction itself or from the production of  $\text{CO}_2$  by the burning of fuel directly in the reactor, would cause a large amount of blue powder to form.

Mr. P. W. Carbo's zinc smelting patent has the two important conditions necessary for this type of smelting. It provides indirect heat for the endothermic reaction; and it also provides a method to keep the carbon dioxide content below the critical point thus eliminating the formation of a large amount of blue powder. A sketch of the Carbo patent with all details is shown. The feed consists of minus-60 mesh zinc calcine which assays about as indicated in the diagram. It is mixed in a ratio of three pounds of calcine to one pound of coke. The mixture is fed by a screw conveyor into a cylindrical fluidizing reactor that has a conical-shaped bottom. Fluidizing gas, consisting of nitrogen, or zinc vapor, or carbon dioxide, or methane, is used to suspend the solids. Reduction of the zinc oxide to metallic zinc is accomplished by the reducing agents which are carbon from the coke, carbon monoxide, and perhaps methane.

Reduction produces not only zinc vapor but carbon dioxide as well. The carbon dioxide if present in sufficient amounts will cause the metallic zinc to be converted back to zinc oxide. Mr. Carbo's invention allows a natural gas containing about 90 percent methane to dilute the gas with a high carbon dioxide content. This causes a disappearance of the carbon dioxide to the point that the gas can be cooled to condense the zinc with little formation of blue powder.

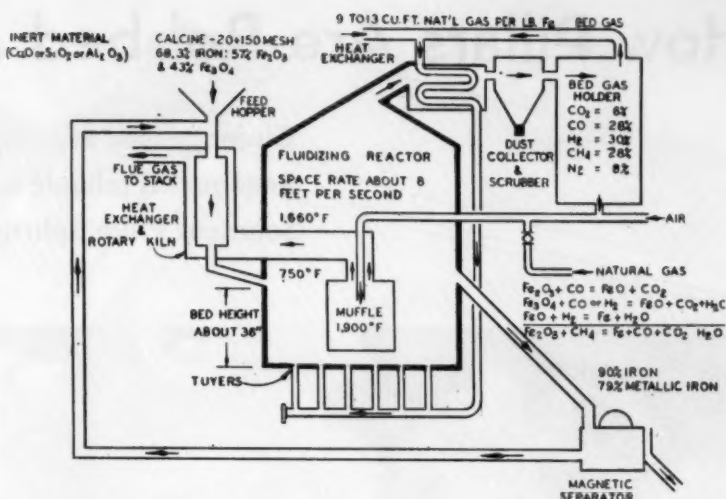
As shown in the diagram, natural gas is introduced into the upper two-thirds of the reactor. The flue gas

containing the vaporized zinc is taken through a filter at the top of the reactor. This is done so that the waste fine solids can be returned to the spent solids that will later be discharged from the bottom of the reactor. The vaporized zinc, along with the flue gas, is taken to a condenser where the zinc is removed in a liquid form.

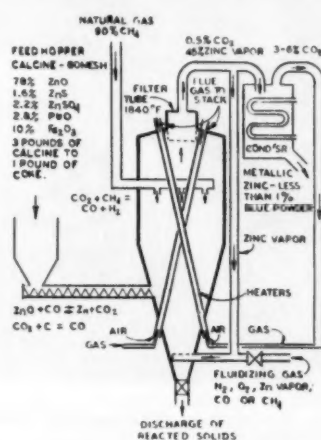
The gas which contains an appreciable amount of heating value is returned to heaters located inside the fluidizing reactor. The heaters are positioned in the reactor in such a manner as to give the maximum amount of exposed surface. The heat generated inside the heaters can be transferred by radiation to the fluidized bed. The temperature maintained in the fluidized bed is around 1,840°F.

The spent solids, which accumulate in the conical part of the reactor, are discharged through a valve located at the lower extremity of the reactor. It should be noticed that if zinc vapor is to be used as part of the fluidizing gas it is bled from the gas stream escaping from the top of the fluidizing reactor. It is claimed by Mr. Garbo that the final zinc metal contains less than one percent blue powder.

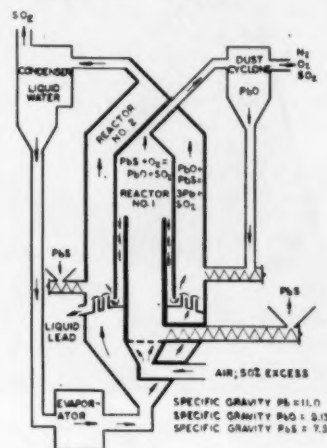
Probably, the most intriguing application of the fluidizing reactor to smelting is the double decomposition reaction between an oxide of a given metal and a sulphide of the same metal. The most promising is, perhaps, the reaction between lead oxide and lead sulphide. The advantages are: (1) Production of a low melting point metal, which might be tapped directly from the fluidizing reactor, (2) A high specific gravity metal which leads to easy separation, (3) Galena, a source of lead sulphide and an oxidation product of lead oxide can be easily obtained from galena, and (4) Under certain conditions the exothermic reaction of producing the lead oxide from lead sulphide may furnish enough heat to make the entire process autogeneous. The Newnam and Scotch ore hearths have taken advantage of these chemical reactions for many years, but have not been too successful because of the high lead loss in the slag. However, under certain conditions it might be possible to produce lead from lead oxide and lead sulphide in a fluidizing reactor with little loss of lead provided the feed is of extremely high grade material. A sketch with this article shows a double fluidizing reactor in which the smaller reactor labeled No. 1 is located inside of a larger reactor labeled No. 2. The No. 1 reactor is used for roasting of galena to produce lead oxide and the reaction is strongly exothermic. The hot calcine containing the lead oxide is transferred to reactor No. 2 by a standpipe and



1. OSBORN PATENT for making sponge iron from pyrite concentrate provides means for prevention of agglomeration and balling of the product.



2. GABBRO PATENT for reducing zinc calcine removes zinc as a vapor.



3. DOUBLE DECOMPOSITION reaction of an oxide and sulphide of same metal.

part of the heat from reactor No. 1 is transferred by radiation to reactor No. 2 to furnish part of the heat necessary for the endothermic double decomposition chemical reaction of lead oxide with lead sulphide to produce liquid metallic lead.

The sensible heat in the flue gas from reactor No. 1 might be partially recovered by having a heat exchanger between it and the incoming fluidizing gas for reactor No. 1. Perhaps this heat would also help to evaporate the water going to reactor No. 2, which is used as a fluidizing vapor to suspend the lead oxide and sulphide particles in reactor No. 2. The calcine from reactor No. 1 containing nearly 100 percent lead oxide is mixed with a stoichiometric amount of lead concentrate containing nearly 100 percent galena. The two solids after being thoroughly mixed and raised in temperature react to form molten

metallic lead and sulphur dioxide. The main fluidizing gas in reactor No. 2 is water vapor. The flue gas leaving reactor No. 2 contains water vapor and sulphur dioxide which is cooled to condense the water, thus allowing a simple means of separation between liquid water and gaseous sulphur dioxide. The liquid water can then be evaporated by the use of a heat exchanger between the condenser and evaporator using excess heat from reactor No. 1. Then the vaporized water can be reused as a fluidizing gas in reactor No. 2. If all calculations are correct, if the raw material is very pure, and the proper temperatures maintained, it might be possible to have a completely autogeneous process and a final chemical reaction of two solids reacting to produce a liquid metal and a gas thereby leaving no residue in reactor No. 2 to be discharged.



# How Pillars Are Robbed at Westvaco

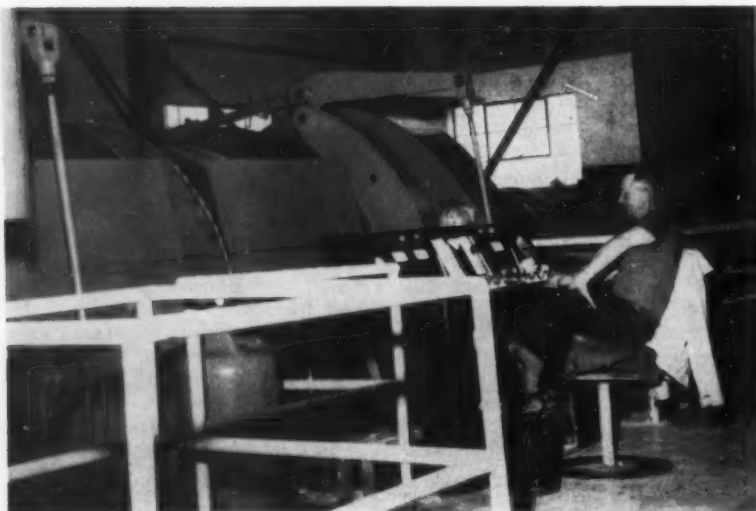
**Given:** Bedded deposit; back too weak for longwalling

**Required:** A reliable method for total extraction

**Solution:** Pillar splitting; controlled caving of back



STOCKPILING crude trona hoisted through No. 2 production shaft equipped with automatic skip loading and hoisting system.



NORDBERG, 500-horsepower hoist raises 6.5 ton skips. Roebling cable has internal 3-conductor communication line.

Intermountain Chemical Company's 1,500-foot-deep trona deposit 20 miles northwest of Green River, Wyoming, has always been plagued by the twin problems of a weak roof and floor. But a systematic method of pillar splitting developed by the staff now permits near total recovery of the sodium sesquicarbonate ( $\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3 \cdot 2\text{H}_2\text{O}$ ) ore body at a rate that compares most favorably with mechanized first-mining by room and pillar methods.

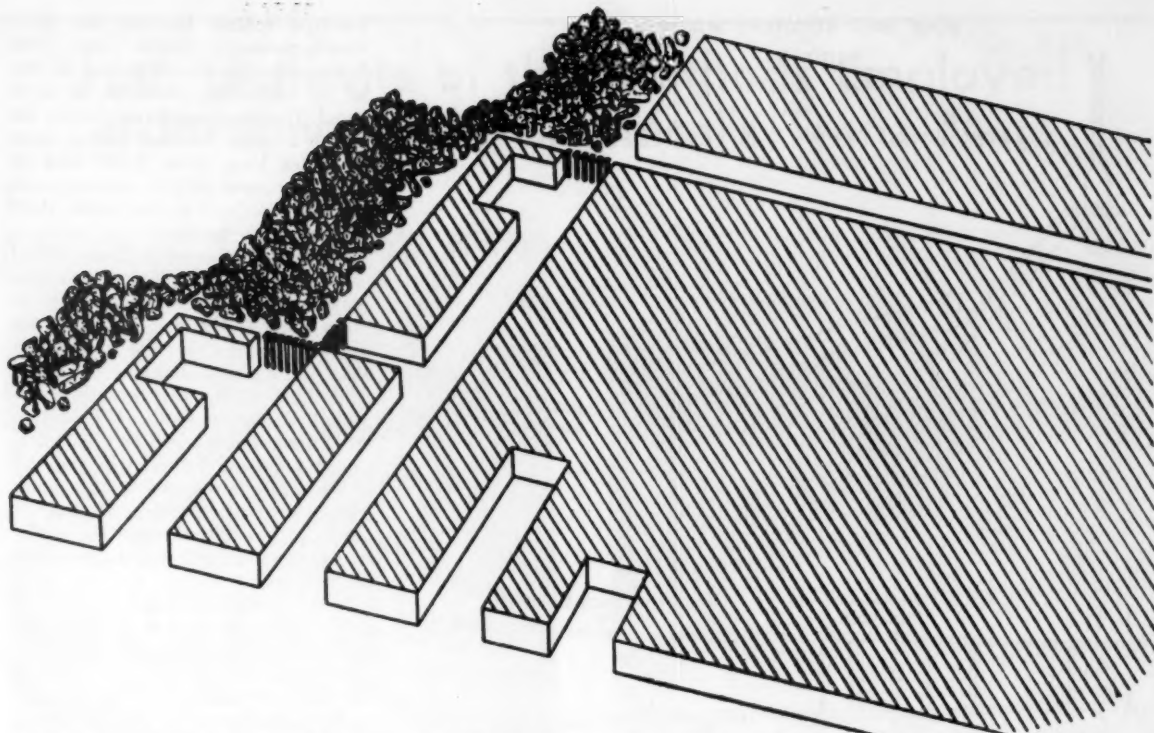
This is how pillar splitting works at the mine. A cut or lift is driven at right angles to a completed room heading, leaving temporary fenders of ore and a breaker row of stulls adjacent to the retreating cave line. When the lift is completed, the fenders are drilled and loaded with powder. The stulls are then yanked and the fenders are blasted allowing the back to cave.

Though pillar work is still only in an infant stage at the young mine, management is proud of the record that has been compiled. Problems of squeeze and weight transfer to active headings have been controlled. And the rate of pillar recovery has been outstanding.

Initial panel and room development accounts for 30 to 35 percent extraction of the deposit during first-mining. During this period you might expect productive efficiency to be high in a modern, well-equipped mine since roof control and floor heaving difficulties would be at a minimum; therefore, planned cycles are easier to maintain. At Intermountain Chemical, output during first-mining has risen to 50 tons per face-manshift, an enviable figure by any standard. Yet the well-planned system of robbing pillars yields nearly comparable results—44 tons per face-manshift during retreat from the panel. Over-all output per underground worker during both first-mining and pillar recovery is 25 tons per manshift.

Personnel at the Westvaco mine are the first to admit that they don't have all the answers or the universal solution for pillar extraction problems. They are still experimenting with patterns and methods because the mine is only a few years old. Limited pro-





**PILLAR WORK ON RETREAT** begins immediately on completion of a room. Soft bottom and weak roof limit initial room mining widths so pillar recovery is important. Fenders next to

cave are not recovered, but are blasted before new pillar cut is started. Pillar splitting as shown in diagram permits near total extraction of core.

duction first began in 1947, but commercial scale output was never attained until 1953 when the \$15,000,000 surface facilities and production shaft were completed. Today the mine is one of the most efficient in the United States; yet the staff still hopes to make further improvements and economies. Pillars have been robbed from three panels (each measures 500 feet wide by over  $\frac{1}{2}$ -mile long), and these are some of the fundamentals that have been learned.

First extraction should be kept low. An attempt to get 50 percent recovery on first-mining revealed that weight was transferred to adjoining blocks.

Any advantage in higher extraction during first mining was usually offset by floor heave and greater difficulty in controlling the back.

The rate of retreat should be fast.

Caving must be complete in order to relieve the pressure. At the Westvaco mine it has been possible to successfully cave a roofbolted back. (A unique, long-handled wrench has been developed by the staff to recover rockbolts prior to caving and has resulted in considerable savings in bolting costs.)

The huge deposit developed by the mine occurs in a 10-foot-thick, nearly horizontal bed of the Green River formation which is of Tertiary age. Mining is limited to an 8-foot height because the upper 2 feet of the trona bed is so intimately interbedded with shales that some measure of selectivity is required. The flat deposit is covered with over 1,500 feet of shale and sandstone overburden that contains high alkali beds at intervals in the lower 400 feet. The main trona bed is underlain by a high quality oil shale. Both the back and the floor are relatively weak. The roof requires support during panel and room development. Originally timber was used, but now the back is rockbolted using a  $\frac{3}{4}$ -inch by 5-foot-long, high-tensile steel bolts with Patten expansion shells.

Methane gas, contained in the overburden, is released when the overlying shales crack and cave following pillar removal. For this reason ventilation is most important at the mine and only "permissible" equipment can be used. Some roof failures have been traceable to gas pressure in the overburden above mine workings.

The trona in the main bed is about 95 percent pure. In physical characteristics it is harder, heavier, and more abrasive than coal. Ore in place weighs about 130 pounds per cubic foot (15.2 cubic feet per ton). Hard-

ness of trona is 3.2. The ore is only slightly corrosive. It has little effect on iron or steel. But it is mildly corrosive with respect to active metals or alloys composed of the more reactive metals.

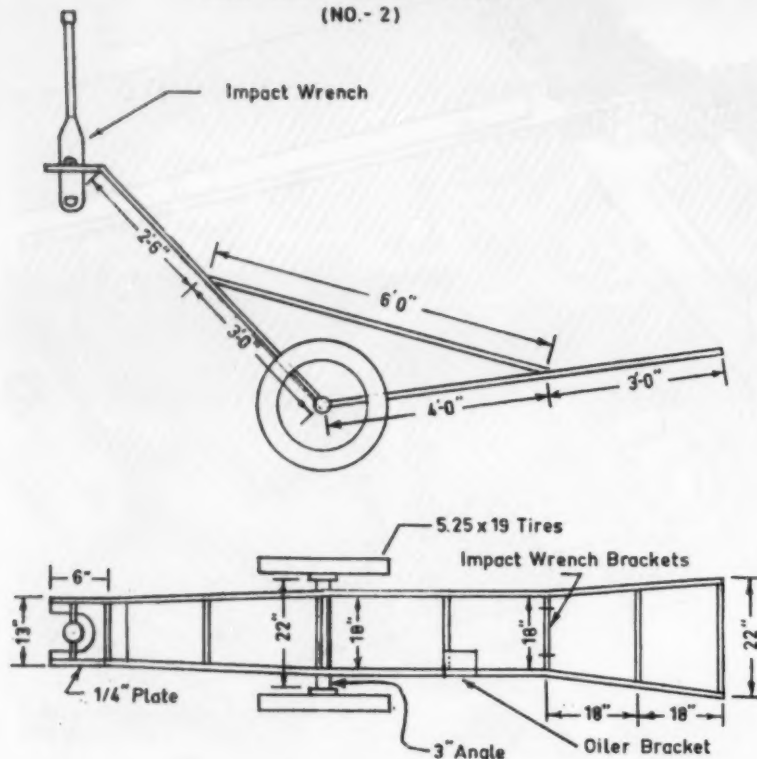
The size, shape, and physical characteristics of the ore and surrounding rock suggested a room and pillar method of development. Since total or near-total extraction was desired, a plan for robbing pillars was required. It was suspected that the roof was too weak to successfully employ a longwalling method. This has been proven by practice. A brief experience with longwalling at Intermountain Chemical showed that the back tended to shear directly above the advancing longwall. Since the roof needed close support, some variation of a pillar splitting method was needed to obtain maximum recovery while providing the necessary protection for men and machines.

The method now in use answers the primary requirements for safety and total extraction. The fact that the roof was too weak for longwalling is turned to advantage in maintaining the proper caving action which is so essential for relief of overburden and prevention weight transfer to pillars around active roof headings. Intermountain Chemical's pillar splitting method also meets the following specifications.

It removes the entire trona bed with

## ROOF BOLT RECOVERY MACHINE

(NO.- 2)



ROOF BOLT RECOVERY MACHINE used before fenders are blasted and roof is allowed to cave. About 30 percent of installed bolts are recovered at a labor factor of 17 to 18 bolts per man hour.

the exception of minor stumps which are blasted before retreating. Short of drilling and blasting the back, this is about all that can be done to promote good caving action. The system has shown reasonably good success in relieving the weight of overburden. There are areas where pillars show evidence of taking weight and floors will heave; but when are conditions ever perfect for pillar extraction?

### Straight Cave Line On Retreat

Pillars are removed according to a planned pattern which maintains a straight cave line on the retreat. The cave line advances in orderly fashion and the danger of arching is minimized. Pillar work follows almost immediately on the completion of each room heading with a panel. This pattern, in turn, allows concentration of equipment and personnel in active headings near the retreating cave line. A minimum number of rooms are opened in advance of pillar extraction—only enough to provide sufficient working faces for proper rotation of equipment during work cycles. Supervision is easier since a minimum number of active areas are in progress in

each panel.

Extraction by the pillar splitting method is fast. This factor contributes to minimum difficulties with ground control. Since pillar recovery takes place on retreat from the panel, the need for large barrier pillars is reduced. Pillar extraction on a retreat method also simplifies the ventilation problems. The rapidity of pillar recovery allows little time for air slaking to take place or for weight to develop on adjacent pillars.

Pillar splitting method at Intermountain Chemical also lends itself to mechanization with the same equipment and conveyor belt set-up used for driving panel entries and rooms. In short the method meets satisfactory standards for control of ground conditions.

The Westvaco mine represents a typical example of the adaptation of coal mining equipment and methods to a nonmetallic deposit. The Paul Weir Company, consulting mining engineers, assisted Intermountain in developing mining plans and methods. Production machinery includes undercutters, hydraulically controlled drill jumbos employing auger steel, duck-

bill-type mobile loaders, and electrically-powered shuttle cars. The latter move the ore 500 feet or less to an extensible conveyor in each panel. The panel conveyors deliver the ore to a main line belt system over 1½ miles long. Over 3,000 tons of ore transported daily to underground crushing facilities at the muck shaft by the conveyor system.

The mine is opened by three vertical shafts. Two are centrally located at the northeastern end of the workings in the vicinity of the surface plant. One of these serves as the production shaft and the second as a service shaft. The third shaft, just recently completed, is located south of the active mining areas. It is an 18-foot diameter, concrete opening through which all the intake air is introduced to the mine. The flow of air is uni-directional, as nearly as possible, through the workings to the two northeast shafts which are on exhaust.

Main headings are driven on a 6 or 7-entry system and they bisect the block of ore now outlined for development from the present shaft set-up. The 500-foot-wide panels are laid out on both sides of main entry development. Panels are developed by a 4-entry set of headings, each of which is 12 by 8 feet in cross section. A minimum of five active working faces in combined first-mining and pillar work are required to maintain efficient equipment cycles.

Unit work operations within the panel are carried out with 8-man crews and includes the following:

**Undercutting** which is done with a Joy 10RU universal machine equipped with a 10-foot bar. A vertical cut is used which provides two faces for blasting. It is placed either in the center of the face or offset left or right depending on what throw is desired.

**Drilling** of 12.5 foot, 15-foot, 20-foot, and 25-foot-wide rounds is done with a Joy, self-propelled, twin-boom jumbo, mounted on rubber tires and carrying two CD-42 auger drilling machines. Holes are drilled to pattern and penetration rate is 10 feet per minute.

**Blasting** is carried out by using 1- by 16-inch cartridges of Dupont 40 percent volume strength or Hercules 35 percent volume strength powder which is timed with millisecond delays.

**Loading** is handled with a Goodman 665 machine capable of mucking at 10 tons per minute and 1,000 tons per machine shift. **Haulage** of ore to panel belt is undertaken with Joy 10SC rub-

# Four Elements of the Methods Employed at Intermountain Chemical's Trona Mine

1.-



VERTICAL CUT in face reduces powder consumption and permits wider hole spacing. This cut is offset to right so blast will throw ore to right for easier clean up. Joy 10RU universal cutter makes 4- to 6-foot high cut 10-foot deep.

2.-



HIGH CAPACITY Goodman 665 loader with swinging head and tail loads up to 10 tons per minute. It was modified slightly to handle trona and beefed-up by adding separate side clutches on each gathering chain drive.

3.-



ELECTRIC POWERED Joy 10SC shuttle cars with trailing cable handle about 600 tons per car shift. Haul length is usually less than 500 feet, but 600 feet of small sized No. 4 cable is wound on car cable reel.

4.-



PREFABRICATED TUNNEL LINERS make this overcast to separate and force vitiated air over the top of heading in picture which is on fresh air. Tom Bernatis, mine superintendent, makes his rounds in battery powered golf cart.





**ROBINTRONIC PROTECTIVE DEVICES** on belt conveyors cut patrol from six to one man per shift. Saving: \$60,000 per year. This Hewitt-Robins unit (circled) sends signal when chute plugs and shuts off belt before damage can occur.



**PATTERN ROCKBOLTING** has been perfected so hole is drilled and bolt installed in less than two minutes. Joy RD8 hydraulic unit with dust catcher drills holes. Patten 4-inch bolts with expansion shell are used.

ber-tired shuttle cars carrying 8-ton loads. Normally two, sometimes three shuttle cars work with each Goodman loader.

**Rockbolting** is done with a Joy RBD8 or RBD11 auger machine which puts in a 5-foot-deep hole in the back. Each bolt is installed and tightened to 200 foot-pounds by the drill chuck. This completes the work cycle on room advance.

Retreat on pillars employs the

same equipment plus:

**Rockbolt recovery** which is facilities by use of an impact wrench carried on steel frame mounted on rubber tires.

**Secondary ore transport** from panel to main-line conveyor is carried out with extensible conveyors. Rope belt conveyors made by Joy and Goodman have recently been installed. Prior to this all secondary ore transport was over Continental Gin conveyors. Belts on conveyors are 36 inches wide.

**Primary ore transport** from panel conveyor to shaft is over two Goodman conveyors which are 36 inches wide. Use of plug-warning devices and electrical interlocks allow one man to effectively handle patrol of over 6,000 feet of main-line and all-panel conveyors.

### **Pillar Recovery Speeded**

Within a panel under development, recovery work on pillars starts almost immediately after the far set of four or five rooms holes the No. 4 entry of the adjacent panel. At the bordering panel, on the north, where the holing occur, retreat and caving has been completed with the exception of a row of chain pillars between panel entries Nos. 3 and 4. The chain pillars are left to protect the new block until it is developed. Initial pillar extraction takes place on the chain pillar, at the inside end of the room, and retreats towards the belt haulageway. Withdrawal is staggered in the far set of rooms so that the cave retreats toward the panel entries on a 45° angle to the rooms. Pillars are extracted by taking successive cuts leaving protective fenders next to the cave line. As a further measure for controlling the back, a row of stulls is installed across the room at the fender line to help support the back. From the time that retreat and caving is initially established in the panel, development of new rooms takes place only singly or in pairs, and just fast enough to maintain the 45° line and necessary working faces.

Fenders of ore and stulls are required because the back is too weak to permit ends of pillars to be worked next to the cave line. They keep waste from rolling into the active working area of the cut. The fenders are shaved as small as possible, consistent with safety and the condition of the roof. Most of the ore remaining in the fenders is lost but this represents only a very minor percentage. The stumps left for fenders are drilled and loaded with powder immediately after the cut is cleaned out. This round is timed

with millisecond delays and the wiring is strung up out of the way of roof bolt recovery equipment.

The next step in completing the cut before retreat, consists of reclaiming as many rockbolts as possible using the long-handled power wrench. This unit has the advantage of allowing the operator to work under a safe bolted back. In the meantime a second barrier of stulls is installed across the room just behind the pillar cut. One or two stulls are left out of this screen for passage of the rock bolt recovery machine.

Recovery of bolts using the unit designed by the staff has met with outstanding success and has materially contributed to lowered operating costs. About 30 percent of the rockbolts installed are recovered. As a yardstick to give an indication of economies, rockbolts account for 28 percent of the total operating supplies expense of the mine. They are the second largest supply item required and are topped only by the expense for blasting materials. The operator works about 12 feet behind the wrench and he can recover 17 or 18 bolts per man-hour.

After all recoverable rockbolts are reclaimed from the cut, the inside row of breaker stulls are taken out. One method of doing this is to loop a cable around the set of stulls and jerk them out with a shuttle car. If they won't come, they have to be popped out when the stumps remaining for ore fenders are blasted. There is very little trouble experienced in obtaining caving if the stumps are properly blasted and the stulls removed. The ground caves to the second row of stulls. When it has stabilized reasonably, a second cut can be taken in the pillar.

In effect, the system which has evolved at the Intermountain Chemical Company is one of room and pillar mining with continuous retreat on the ore pillars. Look for further changes and improvements at this mine which has been developed into a model of efficiency, equipped with the best machinery that money can buy. Tests are going forward in a number of directions. These include studies of continuous mining; an experimental machine is now at work. The staff is confident that some day continuous mining will prove practical. A strain gauge is being developed to measure roof stress. Perhaps some correlation will be developed between pillar size, spacing, and stresses leading to ultimate roof failure. With an alert staff carrying on these and many other studies, who knows what methods will be developed in the future. Only one thing is sure. Extraction efficiency is bound to improve.

**THE END**





## Raising Through Sand Filled Stopes

A quick, safe, and cheap method for driving a vertical chute, manway, or ventilation opening through sand filled stopes has been developed by the Zinc Corporation Limited at its Broken Hill, Australian mine.

The first step is to jet a pilot hole from the level through the sand fill to the working stope. An air and water jet nozzle was set on the end of a ½-inch pipe and washed into the fill from the back of the level. Four-foot lengths of pipe were added to the jet as it washed its way upward. A 50-foot-long hole will break into stope with about a 2 inch diameter, the bottom having enlarged to about 6 inches. A chute is then built under the bottom of the hole so that sand will wash into mine cars.

Activity is then transferred to stope where the pilot hole is enlarged from top downward with a water jet with the sand dropping into car on level below. As hole is washed, larger round, sheet metal pipe is added in short lengths and dropped in the hole for casing. When casing reaches the level, it forms chute through which sand is then shoveled.

A shaft is then sunk through the fill by mucking sand into steel chute. Wooden cribbed sets to form desired shape and sized opening are placed from top downward as quickly as sand is removed. The steel chute is removed in sections as sand is mucked away and is available for reuse.

## Two-Way Radio Saves Texas Zinc

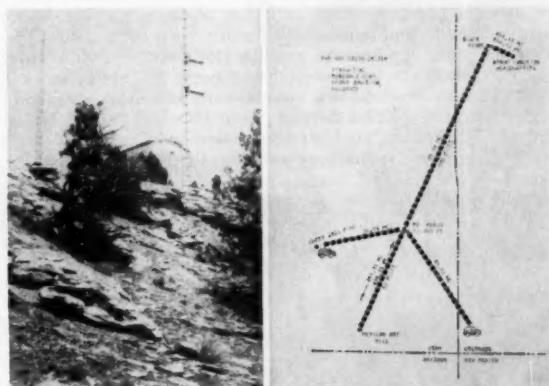
When N. K. Banks, general manager of Texas-Zinc Minerals Corporation, in his Grand Junction, Colorado office wants to talk to Arch Boyd at the Happy Jack uranium mine in White Canyon, Utah 150 miles away, he picks up the company's two-way radiophone and makes the call. Similarly, he can call the mill at Mexican Hat, or the field geologists can talk from their cars to the mine, all through a two-way radio system supplied and installed by Motorola, Inc. Installation of the system was necessary as there was no other means of communication, short of driving or flying, between the main office and the remote operations on the Colorado Plateau.

With 150 miles of mountains and canyons separating Grand Junction and Mexican Hat, reliable radio communications could be difficult. However, the advantageous location of radio relay stations on the highest mountains (see map) provide the answer. Two radio repeater stations were installed—one on 8,000-foot Black Ridge, 20 miles from Grand Junction; the other on Mt. Abajo, an 11,000-foot peak 50 miles from Mexican Hat. These stations automatically retransmit all messages received, whether from mobile units or the fixed control

stations in Grand Junction and Mexican Hat.

Step by step, the system works like this. A call originating in Grand Junction is broadcast on a 450 Mc. frequency to the Black Ridge site. Here, it is retransmitted by a 250-watt unit on a 30 Mc. frequency to all mobile units and the Mt. Abajo repeater. This repeater again retransmits the signal, this time on a second 450 Mc. frequency which is received in Mexican Hat.

Besides this fixed equipment, the Texas-Zinc system contains three Motorola 60-watt mobile units, operating on the 30 Mc. frequency. The men in these vehicles can talk to each other or to either Mexican Hat or Grand Junction—through the mountaintop repeaters, of course.

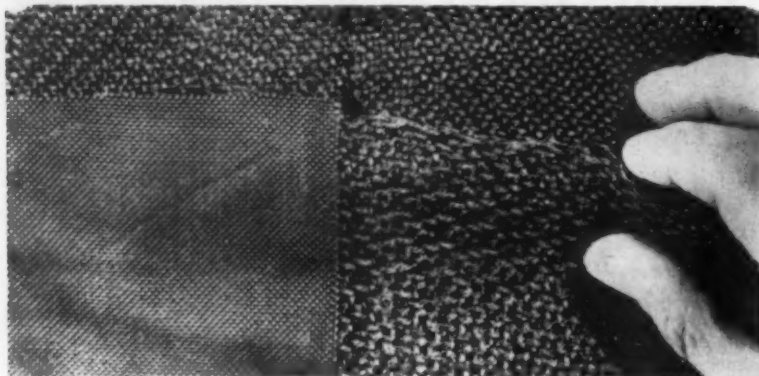


The radio system paid for itself many times over in handling the inevitable emergencies during construction and early months of operation. In 1958, for example, a gear motor in the conveyor system burned out. Since the conveyor was the only means of carrying ore into the mill, the trouble meant shutdown of the entire plant. The trouble was reported immediately by radio to Grand Junction. The part number and possible alternates were transmitted. Within minutes Grand Junction personnel were phoning suppliers across the country for the needed gear motor. The nearest exact duplicate was in Atlanta, Georgia. An alternate was found in Denver, Colorado. It was determined through phone and radio that the alternate was an acceptable substitute, so a charter plane in Denver was hired to fly the alternate motor to the mill's airstrip. Several hours later, the plane landed and installation was begun. By late afternoon of the same day the conveyor was in operation and production of "yellow cake" was resumed.

Without radio, it would have taken an extra day or longer to get the mill back into operation, or else require a much larger inventory stock of spare parts and supplies to be maintained at Mexican Hat.

# PRODUCTION EQUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.



## Graphite Fabrics Available

Manufactured graphite can now be produced in flexible fiber or fabric form according to National Carbon Company, Division of Union Carbide Corporation. Any textile form—yarns, braids, and felts, or fabrics that are woven or knit—is now available. In mineral processing applications, graphite cloth of the proper mesh could be considered for bag type filters for hot non-oxidizing gases; for equipment to handle corrosive fluids; in electrostatic precipitators, curtain walls and flame arrestors. Possible mechanical applications could combine thermal properties with self-lubricity, and include valve packing and gasket materials for high-temperature seals. Conveyor belting for high temperature process equipment is another possibility. Circle No. 7.



## Side-Dump Bucket Reduces Tractor Maneuvering Time

New loading techniques are offered by the Libu bucket because it can be tilted as desired to the right, left, or forward. Most conventional buckets can only tip forward. The bucket reduces maneuvering of the tractor to get into a dumping position. The side-tipping function of the Libu bucket is based on the principle of the open-sided bucket which swivels about a central pivot. The manufacturer claims that bigger lumps can be loaded with the Libu bucket than with comparable "can-shaped" buckets. In underground work the flexibility in dumping positions offers obvious advantages. The unit was developed in Libu Shovel Co. AB in Sweden. It is also available from the Libu Shovel Company in Great Britain and through Caterpillar Tractor Company in the United States. Circle No. 5.

## Snap-Trac Lugs Provide Traction For Mining Work

Here's a new traction aid claimed to double traction in off-the-road work on either new or old tires. Snap-Tracs, manufactured by Snap-Trac, Inc., 512 Everett Bldg., Akron, Ohio, are made in sizes for trucks, earthmovers, graders, tractors, etc.



Under load, Snap Trac's scoop sections open on ground contact, dig in for traction, then snap back against the tire, effectively cleaning themselves of snow and the worst gumbo. No interference is offered to fenders, side rails, etc. Designed primarily for off-the-road use, Snap-Tracs may be run on the highway at speeds up to 20 mph. Circle No. 49.

## New Unit Directs Conveyor Around 90 Degree Corners

Belt conveyors that go around corners are described in Joy Manufacturing Company's new four page bulletin LD-109. Joy Belt Turn units are simple devices that direct conveyor belts around 90° corners without adding drives or interrupting the belt. They permit storage of enough belting for 1,000 feet or more of continuous miner advance. The Belt Turn is the development of an idea originating with a major coal producer. The unit is skid mounted and contains live pulleys oriented at 45° to the direction of travel and a snub pulley around which the belt is wrapped for travel in the new direction. Units can be dismantled and reassembled for right hand or left hand turn. For further information circle No. 45.



## A New Front End Loader

The new TL-14 TractoLoader offers a top travel speed in either direction of 26 miles-per-hour. The manufacturer claims that it is easy and safe to handle because the unit has rear wheel power steering and four wheel power brakes that can be operated by either the right or left foot.

A few specifications are: Weight 14,480 pounds; carrying capacity 5,300 pounds; maximum lifting capacity 11,000 pounds. Six buckets are available ranging in size from one to three cubic yards. Choice of bucket size depends on weight of material to be handled. The manufacturer is Tractomotive Corporation. Circle No. 1.

## New I-R Deep-Hole Drill Has Reverse Rotation Feature

Ingersoll-Rand has introduced a new, heavy-duty deep-hole hammer drill that utilizes conventional (left hand) rotation as well as reverse (right hand) rotation. A selector incorporated into the back-head permits instant changing of the rotation so that the power of the drill can be put to work for coupling or uncoupling steels, a very useful feature for efficient deep-hole work. The new drill is called the Model D40.

The D40 has a 4-inch bore and handles bits up to 3 inches in diameter. It is designed to be used with the Ingersoll-Rand FM4 Drill Guide, which means it can be applied to self-propelled mountings such as the Ingersoll-Rand CRAWL-IR; and to Wagon Drills, Hydra-Booms and Pipeline Mountings that can utilize this Drill Guide. Circle No. 47.



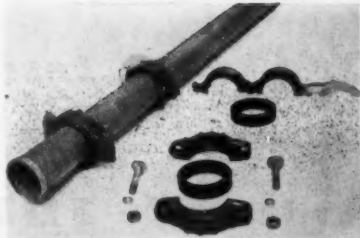
### 70 Cubic Foot Skip Speeds Mucking Cycle

Machinery Center Inc., of Salt Lake City, Utah has developed a large 70 cubic foot safety sinking skip that speeds up the mucking cycle because of its greater capacity and faster dumping action. The skip is attached to two 30-foot, 3/4-inch cables which are fastened to a bridle on the main hoisting cable. These cables pass through the standard crosshead and fasten onto the sides of the sinking skip below the crosshead. On reaching the lowest set of timber in the shaft the crosshead comes to rest, secured by chairs, and locking lugs holding the torpedoes are opened by the chairs allowing the torpedoes and skip to pass to the shaft bottom. As the loaded skip leaves the bottom the torpedoes activate the locking lugs, locking crosshead and skip together for movement in the shaft. In event of cable failure, dogs on the crosshead grip the timber guide rails and prevent the unit from falling. For further information circle No. 51.



### Quick Section Locator

Transparent plastic template laid over any standard map with township boundaries instantly locates any section. The 3 3/4 by 6 3/4 inch template has four map scales on it, two templates form set. Templates fit maps with scales of 1-inch to 2, 3, 4, 6, 8, 12, and 16 miles. Circle PEP No. 54.



### Thin-Wall Swedish Pipe Now Available in the U. S.

Alvenius lightweight steel pipe, a standard component for compressed air and water lines in European mining, is now available in the U.S. market for the first time. The pipe reportedly weighs approximately one-third that of standard U. S.-made steel pipe. It is cold-rolled from quality Swedish steel which is said to have made possible a thin-wall pipe with a strength of 104,000 psi. Pipe ends are reinforced by a pressure-welded external ring, which also serves to hold the coupling firmly in place. Couplings allow for an angular deflection up to 10°. Atlas Copco Pacific Inc. has been appointed the first distributor in this country. Circle No. 4.



### New Mercedes Benz Trucks

Daimler Benz in Germany has introduced a series of new truck models which are said to offer outstanding payload to vehicle weight ratios, low fuel consumption, and comfortable driver's cabs. Payload to weight ratios range up to 1.83 to 1. The new series range in total weight from 10.5 tons to 12 tons, and in engine power from 120 to 190 horsepower. The three basic models are produced in 63 series modifications for special purpose job application. Circle No. 61.

### How To Use and Handle Sodium Chlorate Oxidant

As an aid to the uranium milling industry, which is using increasing amounts of sodium chlorate as an oxidant, a new Technical Bulletin, No. C-5001 is available from Pennsalt Chemicals Corporation's Washington Division.

Properties, solubilities, shipping regulations, safe handling practices, unloading in bulk and solution, and dissolving of crystalline chlorate are described. Graphs and sketches add to the value of this bulletin. Circle No. 52 for your copy.

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**ROAD RIPPER TEETH** averaged 7 to 10 times more life after receiving protection with Tube Borium. Notice how tooth chisels down with wear.



**SHOVEL TEETH** wore out in one 8-hour shift. A few beads of Tube Borium applied during noon break prolong life 6 or 8 full shifts. They are then repointed and hard-faced for further use.

**TUBE BORIUM** is available in stick form for oxy-acetylene or manual electric application. Also in continuous wires for automatic and semi-automatic electric application. Various mesh sizes for individual uses.

### STOODY COMPANY

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Wear and loss of digging efficiency are common complaints on all types of teeth—*ditchers, power shovels, rippers, draglines, dredges, etc.* Hard-facing greatly prolongs useful life. But even so, each tooth can be made to last *far longer than ever before* and retain its sharpness by hard-facing with Stoody TUBE BORIUM!

Why is this one hard-facing alloy so superior on teeth? No other hard metal equals TUBE BORIUM in straight abrasion resistance. Its deposits are thickly peppered with tiny tungsten carbide particles. Wear is virtually defied by this hardest-of all man-made metals.

More expensive in first cost, Tube Borium shows excellent economy in overall service life, outlasting other materials many times over. And longevity is not your only benefit. Remember, one major cost of any hard-facing application is welding time. Use the best, Tube Borium, and you'll save several applications of less effective alloys besides eliminating needless downtime!

Your Stoody dealer (check the Yellow Pages of your phone book) will supply details, literature or recommendations. Ask about Tube Borium—or write direct.



**DRAW LINE TEETH** used in slag dump were hard-faced with Electric Tube Borium—outlasted unprotected teeth 9 to 12 times.



**DITCHER TEETH**—A few ounces of 30-40 Electric Tube Borium on points of teeth increased life 6 to 8 times over factory originals.



**TRANSLOADER:** Sanford-Dry Iron Works, Inc., Knoxville, Tennessee, have available for you a new brochure on their new Gismo Transloader. This unit is a one-man self-loading and self-dumping transport on rubber tires. The Transloader loads, transports, and dumps. Self-propelled, the unit can reach speeds up to 20 miles per hour in either direction. For the full story circle No. 40.

**MAINTENANCE GUIDE** for Caterpillar D2, D4, and D6 tractors has been especially prepared for operators by the Caterpillar Tractor Co., Peoria, Illinois, U.S.A. Over 24 fact-filled pages and 80 full-color drawings make this both an interesting and useful book. Versions in English, French, German, Spanish and Portuguese are available either through Cat dealers or by circling No. 30.

**CERAMIC MAGNET Drum Separator** (Index V) by Stearns is described in a new bulletin published recently by Stearns Magnetic Products, 635 S. 20th St., Milwaukee 46, Wisconsin. The bulletin, #1051, explains how Index V, Stearns' new ceramic magnet material, produces a uniform magnetic field up to 40% more powerful than in ordinary permanent magnet units. Bulletin also has a selection chart indicating size of separator needed for a given capacity. Circle No. 32.

**SODIUM CHLORATE**—Properties and Safe Handling Practices, is the title of a brochure prepared by the Pennsalt Chemicals Corporation. Many useful facts and figures on the compound are given. If you use sodium chlorate in your operation, you'll want a copy of this booklet. Circle No. 33.

**GEOPHYSICS:** Services available from Heinrichs Geoprospection Company of Tucson, Arizona, and some interesting cost and application data are detailed in a brochure just released by the firm. Geocor's mobile (truck-mounted) magnetometer is available on a contract basis. Circle No. 39.

**ROTOCLONES:** A new 20-page product bulletin describing the Type D Roto-Clone dust collector, designed for collecting moderate loadings of dry granular particles, is available from American Air Filter Co., Inc. Circle No. 8.

**HARDFACING ELECTRODE**, now marketed by Stooddy Company following extensive development, yields deposits with high resistance to extreme abrasion, medium impact and high compressive loads. Stooddy reports that Stooddy 2134 may be expected to provide service life surpassed only by tungsten carbides. Circle No. 9.

**CAR SHAKER:** Allis Chalmers has now developed a 3½-ton car shaker designed for small and medium operations. It is similar to the larger 5-ton models now made by the company, and fits all standard gondola hopper-bottom railroad cars in North America. Circle No. 10.

**DRAFTING SUPPLIES:** A new 100-page catalog has been published by Alfred Mosener Company listing drafting equipment and supplies. Circle No. 11.

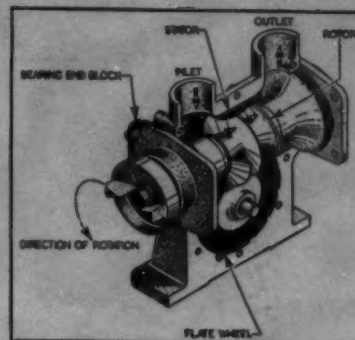
**GRINDING TECHNIQUES** are taken up in an 8-page booklet entitled, "How to Increase Grinding Mill Efficiency," published by Colorado Fuel & Iron Corporation. Factors affecting costs and ball rationing are discussed. Circle No. 12.

**ROCK BITS:** Oil Tool Manufacturing Company has released a comprehensive catalog describing its complete line of rock bits for both air and water drilling. Circle No. 13.

**PACKAGED FEEDER** can be installed in only two steps reports Fuller Company. It is designed to facilitate the introduction of material into any kind of an air pressure conveying unit. Circle No. 14.

**REDUCERS:** A revised 28-page bulletin No. 3100 (dated January 1959) is now available from Falk Corporation. It describes the complete line of Falk helical gear, and integral Motoreducers. Circle No. 15.

**DESIGN FOR PROGRESS:** The Western Knapp Engineering Co., has published a 32-page illustrated booklet called "Design for Progress." The booklet outlines the company's approach to the design and construction of modern industrial installations. Unique methods of WKE project development, project management, design and engineering and plant construction. For your copy circle No. 31.



## Displacement Pump Has Rubber to Metal Surfaces

A positive displacement pump of unusual design has been developed by Goodyear Pumps, Ltd., Camborne, Cornwall, England. The Goodyear pump features engaging surfaces of rubber to metal—an important development in handling corrosive and abrasive liquids or liquids with solids in suspension. The pump is self priming and offers suction lift up to 30 feet at speeds between 750 and 3,000 rpm while maintaining a reasonably constant capacity at any given speed within the above margins at pressures from zero to 100 psi. Compared to the metal to metal pump, the rubber to metal design allows for a greater measure of self compensation when wear begins to take place; efficiency and general performance consequently has a slower rate of deterioration. The Goodyear rotary axial flow type pump is said to be capable of passing quite large solids in suspension. For full details circle No. 46.

**DETROIT DIESEL** Engine Division of General Motors Corp., Detroit 28, Michigan, has developed a 360 hp Diesel. This adds a new high to the horsepower range of Detroit Diesel industrial engines. A 20% gain in horsepower is attained through turbocharging in the Series 110 model. According to the company, the increase in horsepower from 300 to 360 is attained with no appreciable increase in bulk, weight or fuel consumption. Circle No. 38 for additional information.

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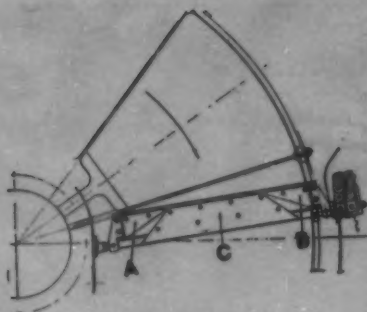
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### New Scraper Cleans Filters

A new contour scraper which folds to follow the contours of the bellow of a disc filter bag assures complete cake discharge, even of thin filter cakes. This results in reduced filter bag costs, lower cake moisture, and greater filter capacity. It was developed by Peterson Filters and Engineering Company.

The contour scraper is a three-section scraper which holds a rubber blade in tension against the bag by plates (A, B, C), which hinge independently of each other. As the bag inflates, the center section, plate C, contours out while the section A & B are held in place and the rubber blade contours to the bellow of the bag. Adjustable spring tension on sections A and B is through an inner shaft to one lever arm and the center section C by adjustable spring tension through an outer shaft connected to the other lever arm. The contouring action remains free and will not freeze up from sludge because all parts are sealed and lubricated. Circle No. 53 for full details.

**NEW SAND AND SLURRY PUMP:** Krogh Pump and Equipment Co., 515 Harrison St., San Francisco, California, have developed the new Krogh Model 600 sand and slurry pump, built to handle all types of sand, abrasive slurries and pulps, ranging from fine slimes up to coarse sand or gravel and rocks. Circle No. 19 on handy reader service card.

**"LUKENS T-1 FOR TOUGHNESS"** is the title of a new brochure prepared for you by the Lukens Steel Company. This interesting booklet describes and gives the varied uses of Lukens T-1 steel. Circle No. 23 for your copy.

**SMIT BIT:** J. K. Smit & Sons, Inc., has an interesting catalog available on their complete line of diamond bits. It describes bits which may be used in many different types of rock. Circle No. 27 for your copy.

**ORE FEEDERS, Vibrating Screens, Rolls, Sand Pumps, Bin Gates and Concentrating Jigs** are described in a new bulletin No. 579 published recently by Morse Bros. Machinery Co. This bulletin contains a wealth of data. Send for your copy. Circle No. 25.

**RADIAL LOADS,** what causes them, how to measure them and how their effects on Peerless process pumps are controlled, is the subject of an interesting new booklet recently made available by the Peerless Pumps Research laboratory. Anyone interested in pumps will want to have a copy of this booklet. Circle No. 26 for your copy.

**WAGON DRILLS** by Ingersoll-Rand are described in a new brochure recently released. Three models are described—the FM-4 Wagon Drill, the FM-4 Rotary and lightweight JHM "Wagonjack" mounting. Circle No. 21 on the handy reader service card for prompt reply.

**HOW TO MAKE GRINDING BALLS:** Here's a chance to learn. United States Steel Corp., has recently published a bulletin describing how USS Grinding Balls are made and what tests are applied to maintain ball quality. Circle No. 24 for your copy.

**VERSATILE ON THE JOB 4-wheel-drive Hough "Payloaders"** units are described in a series of literature published by the Frank G. Hough Co., 859 Sunnyside Ave., Libertyville, Illinois. Units described are Model HO (9,000 lb. carry cap.), Model HH (7,000 lb. carry cap.), and Model HU (5,000 lbs.). Circle No. 20.

**ABRASION PROTECTION** is provided by Gates Vulcoline, a cold bond rubber that can be joined to most materials, including steel, rubber, concrete and wood. Vulcoline comes in 1/4, 1/2 and 1/16-inch gauges and is shipped in 36-inch wide, 50-foot long rolls. Installation is said to be easy, and the customer can line new or existing equipment such as chutes and hoppers or "half-sole" worn conveyor belting. Vulcoline is applied using Gates adhesive and activator. Circle No. 37.

**CONVEYOR BULLETIN:** Custom engineered belt conveyors at low cost are described in a new bulletin published by the Western Machinery Company, Industrial Sales Division, 650 Fifth St., San Francisco 7, California. In addition to conveyor descriptions, the bulletin contains valuable engineering data on how to estimate conveyor requirements, including capacity charts, recommended belt speeds, horsepower requirements, maximum angles of inclination and required conveyor lengths. Circle No. 41 for your copy.

**CONVEYOR CHAIN** of a new, stronger flight design and greater chain strength has been announced by The Long Co., Box 331, Oak Hill, West Virginia. The manufacturer says that the new design also permits easier assembly, lasts longer and improves conveying efficiency. For details circle No. 35.

**H & P CYCLONE:** Recently Heyl & Patterson released Brochure 1157, describing the H & P Cyclone. This brochure is filled with tables and graphs giving performance data of all their models. Exploded views of the cyclones and pictures of field installations provide an additional touch of interest for the reader. Circle No. 29.

**COST RECORD BOOK:** To assist owners in determining the cost of owning and operating equipment, Caterpillar Tractor Co., has prepared a special 24-page Monthly Time and Cost Record Book. Twelve sets of pages are included on which to record, day by day, each month's individual machine expenses for an entire year. At the end of the record section is an annual summary sheet where the totals for each month can be entered to obtain annual cost figures. Circle No. 43.

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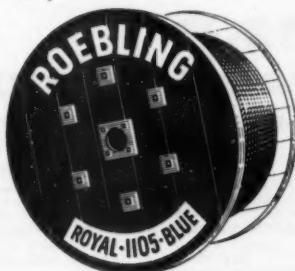
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*When you're talking  
about a \$162,000  
dipper shovel, you've got to  
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the best  
rope for it*



Talking about or working with, the same thing applies. Anything below Royal Blue's performance level is simply unrealistic. Like looking for a cut-price brain surgeon.

Even at \$162,000, the cost of wire rope is important. That's why so-so ropes can cost you more in the long run, because so-so ropes are *short run*. Royal Blue, on the other hand, is built by America's oldest manufacturer of wire rope to last, to do the job without a whimper. Here's why.

Royal Blue is made from the toughest rope wire ever made—Type 1105—extra high-strength improved plow steel. This pedigree gives to the rope qualities that you can't find in any other rope: exceptional resistance to shock, abrasion, fatigue and impact. Add to these a flexibility that age cannot wither nor hustling fade and you've got a collection of characteristics that make Royal Blue the strongest rope you've ever used.

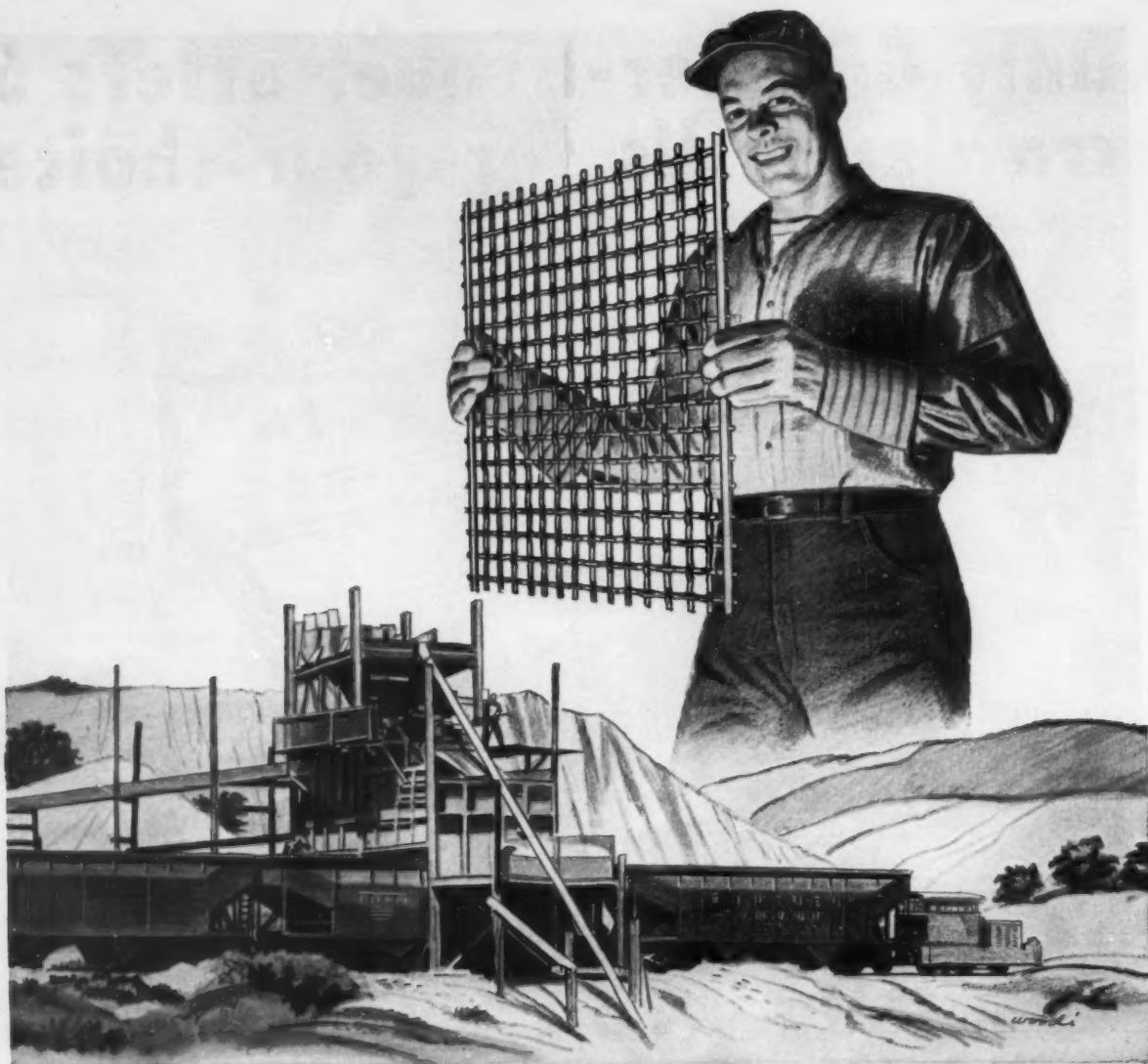
A \$162,000 Dipper Shovel deserves the best and your Roebling Distributor has it... Royal Blue. Any inquiries about this high-born rope will be answered immediately by Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

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## CF&I Space Screens

*reduce cost by cutting downtime*

This Image—the CF&I giant—reflects CF&I's experience and versatility as a *primary producer* of quality steels and hundreds of steel products for industrial uses.

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Because CF&I makes and fabricates its own steel, careful quality-control procedures are possible all

along the line—from blast furnace to wire drawing and weaving. And a wide range of screening specifications are provided to satisfy various

job requirements.

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THE COLORADO FUEL AND IRON CORPORATION



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# Only Gardner-Denver offers 6 crawler drills for your choice

**Swing Boom "Air Trac"® (Model ATD3000)**—drills more holes from one position . . . reaches out to 2½' on both sides of track for a total reach from side to side of 11'10" with boom at 45° elevation . . . drills horizontal holes to 9'6" above ground level. Like all "Air Trac" models, it is self-equalizing, self-stabilizing . . . moves safely, easily over rough terrain.

**"Air Trac" (Model AT)**—the first crawler drill . . . the carrier that made the wagon drill obsolete . . . still the only rig designed to level itself when riding over rough, rocky ground.

**Model AT50**—"Air Trac" with hydraulic drill positioner and hydraulic remote controls.

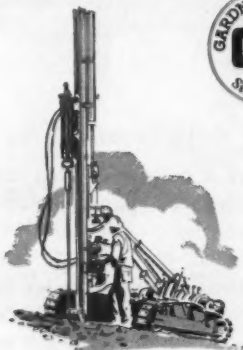
**Model AT1000**—with longer tracks and heavy-duty traction air motors for greater stability in severe terrain.

**Model AT1500**—like AT1000, has longer tracks and greater traction power. Designed for complete power positioning with hydraulic drill positioner and hydraulic remote controls.

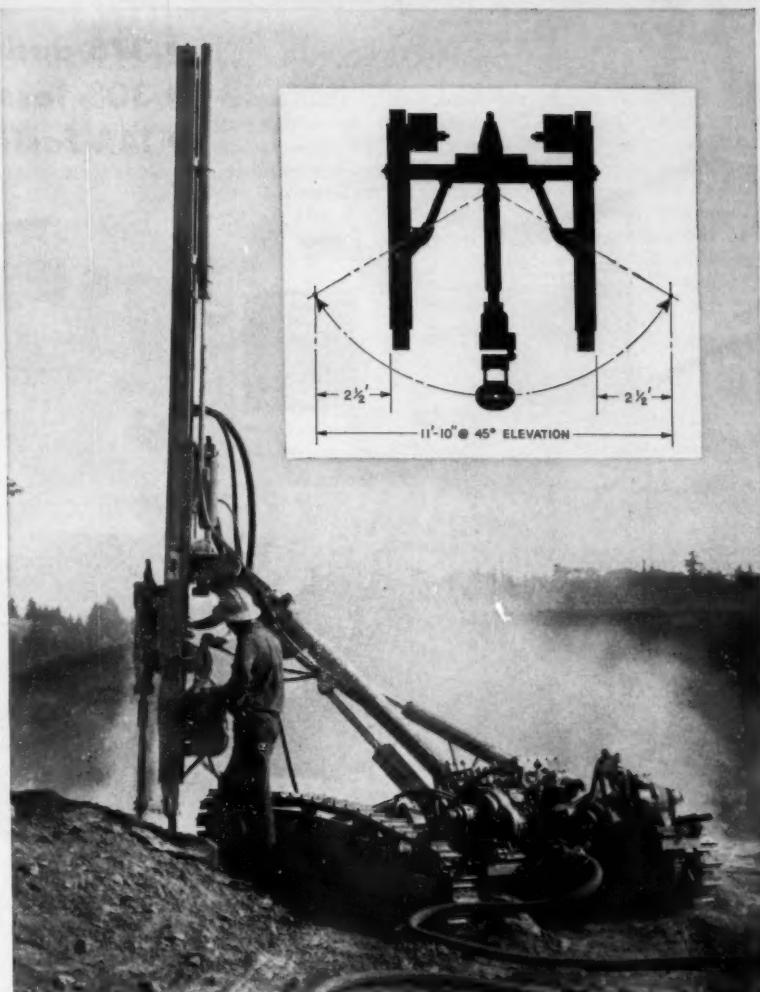
**Model HT-143**—biggest and most powerful crawler drill available . . . carries the hard-hitting Gardner-Denver 5½" drill.

## SETTING THE PACE

The trend to crawler drills in recent years was pioneered by forward-looking engineers and construction specialists who developed the Gardner-Denver "Air Trac," another example of Gardner-Denver's 100-year philosophy of growth—there's no substitute for men.



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**Plus . . .** the most complete line of field-proved drifter drills available . . . and quality, longer lasting Gardner-Denver sectional drill rods, couplings, and ring seal shanks.

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# New 19 and 27

- 375 and 250 hp engines
- 30% less body weight
- 14% faster haul speeds



## NEW "95" Payhauler

**STRUCK: 18 cu. yd. PAYLOAD: 27 tons**

The new Model "95" Payhauler moves payloads faster and for less money than any 27-ton rear dump with cycle-speeding 375 hp under the hood and elimination of all free-loading body weight.

Here's why the new "95" earns more for you:

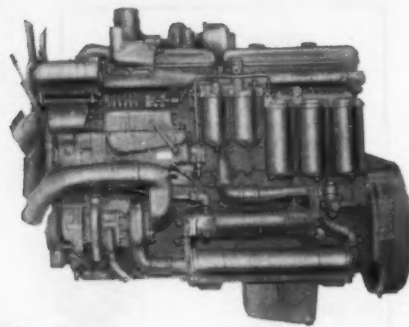
**New 375 hp turbo-charged International diesel engine** plus rugged yet tons-lighter corrugated body gives best power-to-weight ratio of all similar rigs, helps move payloads 14% faster on all grades both up and down.

**Speeds to match all loads and roads** with choice of torque-converter with powershift, or 9-speed, constant-mesh transmission. Haul speeds to 38 mph.

**Faster reversing**, up to 7.1 mph with gear-drive model speeds spotting or positioning for dumping.

**Load-speeding safety** and unequalled operating ease with power steering, torqmatic braking, and full-sweep vision.

**11-second dumping** with exclusive inverted hoist action and industry-topping snubber mechanism.



## Great new 375 hp and 250 engines

Both Payhauler models have a big power plus under the hood. The "95" is powered by this all-new International DT-817 375 hp turbo-charged diesel while the "65" is powered by the same basic engine, the naturally aspirated D-817, that develops 250 dependable low cost hp. Both are heavy-duty, high-speed, direct-start, 4-cycle, 6-cylinder models thoroughly proved in six years of development and testing. Both are products of 26 years of International experience building heavy-duty diesels for rugged applications.

# — ton Payhauler® models

**NEW "65" Payhauler** STRUCK: 12.5 cu. yd. PAYLOAD: 19 tons

The new Model "65" Payhauler sets new performance standards as the only 19-ton off-highway truck on the market...new 250 hp naturally aspirated International diesel engine...best power-to-weight ratio...new rock-

ribbed body with tons less deadweight...10-speed constant-mesh transmission that helps bonus power speed more paydirt...speeds to 36.37 mph...and cab comfort and safety features that let the operator keep his mind on his work rather than on truck controls.

For a refreshing experience in what's new in rear dumps, invite your International Construction Equipment Distributor to bring either Payhauler to your job for a show-down demonstration against your present haulers.



## Biggest body improvement in 25 years

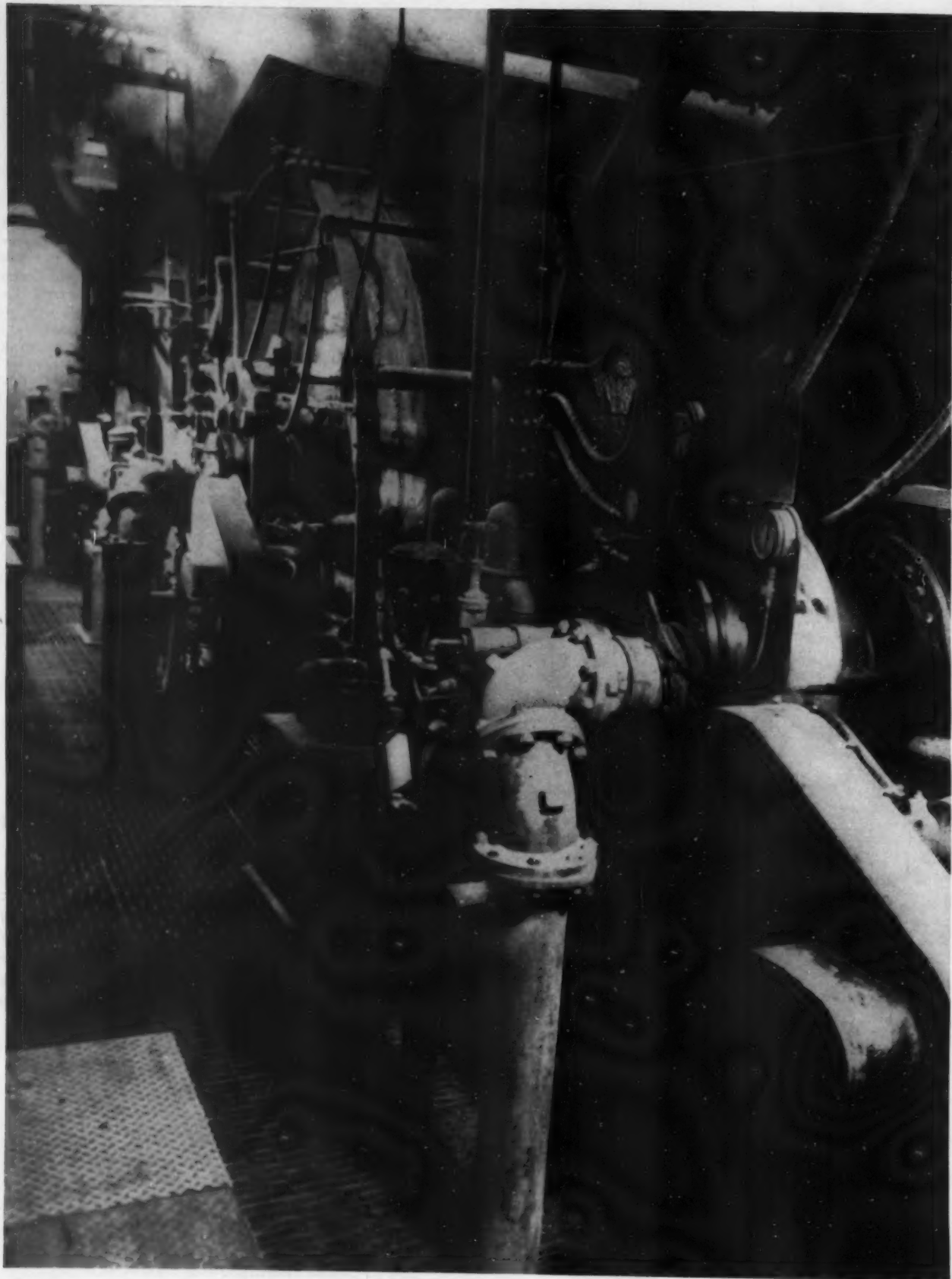
International corrugated quarry and standard bodies are the industry's biggest body improvement in 25 years. Corrugated panels—with triple the strength of conventional flat steel plates—cut body weight 30% in sides, front, canopy, and subfloor at no reduction in strength or protection to operators. Loads being dropped onto the body wear floor are cushioned by up to 26 corrugations in the sub-floor. Patent applied for heated bodies have no cold spots, create no damaging exhaust back pressure. Benefit: haul payloads without hauling up to 5000 pounds of free-loading steel each cycle.



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## SUCCESS STORY AT ANACONDA'S GRANTS, NEW MEXICO, URANIUM MILL

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maintenance down,  
using OLIVER DRUM FILTERS  
with new snap in-out rubber grids*

Ore from the famous Jackpile ore body is processed at Anaconda's Grants, New Mexico, carbonate leach uranium mill. In the 1954 expansion program, three Oliver Continuous Rotary Drum-Type Filters were substituted for batch filtration equipment previously used. Easily removable snap in-out support grids, an exclusive Dorr-Oliver feature, were originally of wire, but have since been replaced by the Company's recently developed rubber waffle-type.

The Oliver filters have been in continuous operation since Spring, 1955, with no shut-downs except for cover changes. Since installation of the rubber grids, tonnage handled has been nearly doubled from 300 to 600 tons per day. Cloth life averages 60 days. The combination of high production and exceptionally low maintenance expense has resulted in substantial cost

reductions per ton of ore treated.

Filtration is carried out in three stages, with repulping between stages. Additional Dorr-Oliver equipment includes O.D.S. Diaphragm Type Pumps on Filtrate and Slurry Service. Slurry handled contains 50% solids. There are also acid-proof Dorr FH Classifiers and DorrClones on acid leaching service and Dorr Agitators on autoclave discharge. A noteworthy feature is the use of Dow "Seperan" to improve filtration. As a result, loss of water solubles has been reduced to a very low level.

The know-how of Dorr-Oliver engineers is based on over 50 years of world-wide experience in handling every type of filtration problem. For more information on Dorr-Oliver equipment or for assistance on your particular problems, write to Dorr-Oliver Incorporated, Stamford, Connecticut.



Photo shows installation of 3 Oliver Drum Filters at Anaconda Copper Mining Company's uranium mill, Grants, New Mexico. Filters are 11'6" diameter x 18' face, with snap in-out waffle type rubber grids. Each filter handles about 600 TPD of ore.

Seperan, Reg. Trademark Dow Chemical Co.

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**Hopper Loader**

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The Eimco 631 is self-loading, capable of both loading and carrying material. It is the answer to many and varied problems of developing and production-loading in stopes, drawpoints and other such areas.

Features include special long tracks for maximum stability and ground contact area; a positive semi-automatic hold-device, for holding loaded bucket in carrying position; heavy-duty and removable hopper with full opening door; improved, heavier equalizer bar; new, improved trunnions and brackets and additional track rollers for a crawler base capable of easily carrying these heavier loads.

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## United States

# Personalities in the News

Robert A. Metz, a geologist for Kennecott Copper Corporation's Chino Mines Division, Santa Rita, New Mexico, has been named senior geologist for Kennecott's Ray Mines Division, Ray, Arizona. He replaced Jacques B. Wertz of Superior, who resigned to accept a fellowship at the University of Arizona where he will work for his doctorate degree.

Harold N. Hedrick has been named manager of the Bartow, Florida operations of Armour Fertilizer Works. Mr. Hedrick supervised construction of plants for Armour before going to Bartow to supervise Armour's entry into the phosphate mining field with construction of its washer, flotation, and drying plants. Following construction, in 1955 he was named head of the mining department from which he was promoted to his new position. George Gagel has been promoted to the post of superintendent of mining and triple superphosphate operations.

Erskine A. Massey has transferred from the Phosphate Minerals Division on International Minerals and Chemical Corporation to the Mining and Exploration Department as mining engineer. He had been assistant mine foreman at Noralyn, Florida since 1954.

Bruno Scipioni has been named chief engineer of the Eastern District operation for Oliver Iron Mining Division, United States Steel Corporation, succeeding John T. Nolan, who recently retired. Mr. Scipioni's engineering duties include the Vermilion Range of the Oliver Division.

The Bunker Hill Company recently announced the appointment of Kinsey M. Robinson and Ross D. Leisk, both of Spokane, Washington, to the board of directors. Mr. Robinson is chairman of the board and president of Washington Water Power Company. Mr. Leisk is a consulting engineer who has been closely associated with western mining since 1919. He was associated with United Verde Extension Mining Company and Sunshine Mining Company. More recently, he has been a consultant in the planning and development of several new mining operations in the Chibougamau district on northern Quebec. For several years he has written the Annual Silver Review for the Mining World Yearbook.

L. J. MOLINARO has been appointed superintendent of the mechanical maintenance department of the Silver Bay (Minnesota) Division of Reserve Mining Company. Mr. Molinaro has been assistant superintendent of this department at Silver Bay since 1955. In 1952 he was employed as assistant superintendent during the construction of the taconite plant, and when this was completed, he joined Reserve.



Newly elected officers of the Minnesota Section of the AIME are: Robert J. Linney, executive vice president of Reserve Mining Company, chairman; Kenneth E. Merklin, metallurgist of Pickands, Mather & Co., first vice chairman; Leon D. Keller, district manager of Dorr Oliver, Inc., second vice chairman; John J. Foucault, manager of Minnesota Mines, Cleveland-Cliffs Iron Company, third vice chairman; and Robert L. Bennett, assistant manager of research, Oliver Iron Mining Division, U. S. Steel Corporation, was reelected secretary-treasurer. Retiring chairman of the group is Stephen E. Erickson, director of beneficiation, M. A. Hanna Company.

R. R. Smith, Ishpeming, Michigan, has resigned his position as metallurgist at the Republic Mine of Cleveland-Cliffs Iron Company, and accepted the position of plant superintendent at the Groveland mine of Hanna Ore Company at Iron Mountain, Michigan.

Edward A. Loria has been appointed development manager, High Temperature and Corrosion Resistant Alloys, for Climax Molybdenum Company, a division of American Metal Climax, Inc. Before joining Climax, Mr. Loria was product metallurgical engineer for Crucible Steel Company of America.

The Mining Association of Montana recently elected Fred Burnett, manager and vice president, Montana Phosphate Products Company, as president for the coming year. Other officers elected include: H. F. Johnson, Silver Bow, first vice president; Dr. A. E. Adams, Butte, second vice president; Stanley M. Lane, East Helena, chairman of the legislative committee; and Thomas Kelley, Butte, secretary-manager. Mr. William Maloney of Butte, who was former secretary-manager, resigned to go into mining-consulting work.

Elmer C. Speers has been named expansion project manager for Kennecott's Copper Corporation's Ray Mines Division, Ray, Arizona. Fred A. Scheuer, formerly a consulting engineer in Los Angeles, has been named mine industrial engineer at the Ray plant, and Fred B. Bialek, graduate of Massachusetts Institute of Technology, has been appointed industrial engineer "A" at the Hayden plant. W. W. Sorsen has been appointed materials handling foreman; Dalton Johnson has been named track foreman at the Ray plant; and James Stocker has been appointed reduction plant maintenance superintendent.

At their annual election meeting, the Montana section of AIME elected the following officers for 1959: James J. Dougherty, assistant superintendent of smelting at Anaconda Reduction Works, chairman; Gerote T. Hanson, Columbia Falls, vice chairman; Koehler Stout, Butte, secretary-treasurer; Guy T. Weaver, Great Falls, John R. Moore, Anaconda, and Cliff Hicks, Butte, executive committee members.

BLAIR W. STEWART, mining executive, engineer, and geologist, has joined the executive staffs of the American Mineral Company, and Desert Minerals, Inc., affiliated producers, processors, and distributors of talcs, clays, and other non-metallic minerals. Since



1942 and until recently Mr. Stewart was with Cyprus Mines Corporation, serving as president and vice president of various mining subsidiaries of Cyprus. Prior to 1942 he held positions of management with William Braden Explorations Company, Basin Tunnel Company, and The Anaconda Company.

August J. Breitenstein has been named assistant vice president of raw materials by the United States Steel Corporation. Mr. Breitenstein joined United States Steel as a mining engineer with the H. C. Frick Coke Company in 1941 after some 10 years experience in the anthracite fields of Eastern Pennsylvania.

Robert J. Russell has been appointed executive vice president of the Hardinge Company, Inc. A graduate of Purdue University, Mr. Russell joined the Hardinge staff as development engineer for pulverized fuel. He specialized in the design and development of grinding and pulverizing systems, and later the design and application of continuous drying equipment. Mr. Russell is the author of chapters for several publications on grinding and drying.

The Potash Company of America, Carlsbad, New Mexico recently announced the promotion of three employees to new executive positions. Houston N. Clark, formerly general superintendent of the Dumas, Texas and Carlsbad operations, has been named assistant to the president. Raymond R. Knill was named general superintendent and will be responsible for all surface and underground operations at Carlsbad and the Dumas sulphate plant. David Rice has been promoted from assistant mine superintendent to mine superintendent at Carlsbad.

Willis M. Johns, geologist for the Montana Bureau of Mines in Kalispell, is currently working with the Pacific Power and Light Company and the Great Northern Railway in a program to investigate raw materials in western Montana. The February MINING WORLD erroneously reported that Mr. Johns was employed solely by Great Northern Railway on this project.

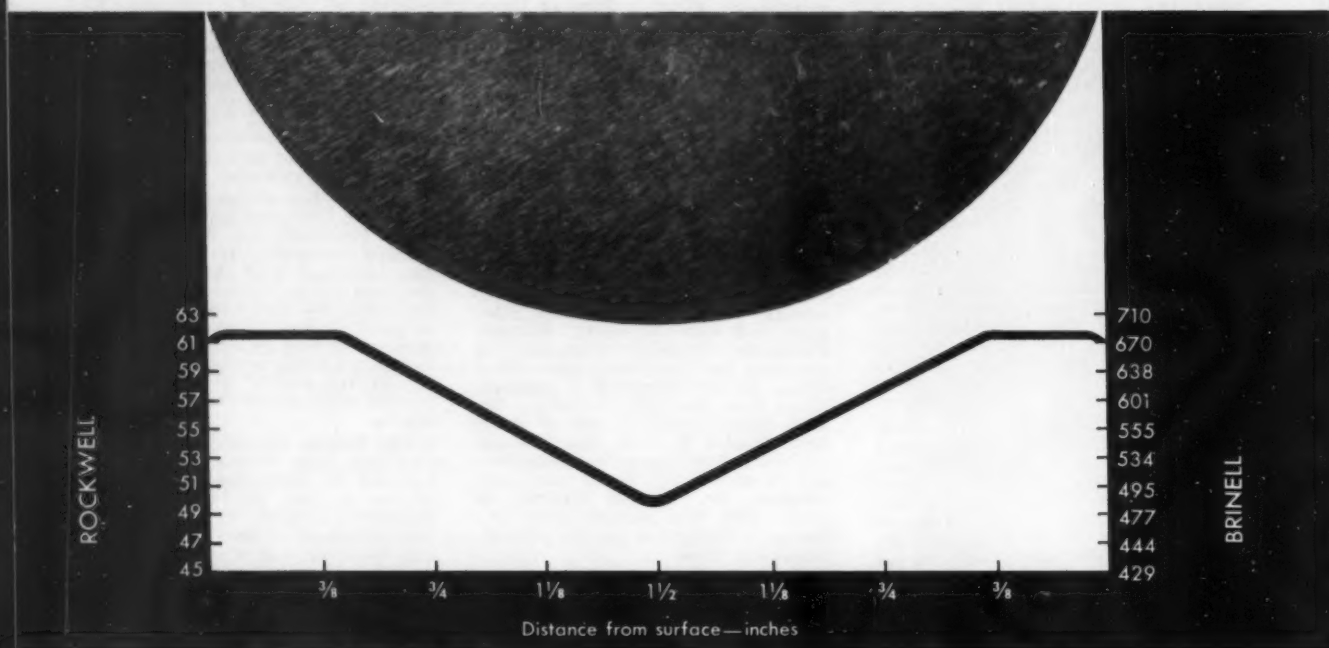
F. O. Griffin has resigned as treasurer and vice president of Western Nuclear Corporation, Rawlins, Wyoming, uranium mining and milling corporation, to accept a position as assistant to the president of the Colorado Oil and Gas Corporation, Denver, Colorado. Mr. Griffin will continue as a director of Western Nuclear.



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# Newsmakers in International Mining

**DR. ALBERT ROBERTS**, director of the Postgraduate School in Mining, Sheffield University, Sheffield, England, will be visiting professor of Mining Engineering at the University of Minnesota School of Mines and Metallurgy during the 1959-60 academic year. He will present lectures and course work in the area of Mine Plant Engineering, with some emphasis on his specialty of mine environment as it relates to ventilation, lighting and industrial hygiene. In addition, he will direct the establishment of the mine plant laboratories in the newly completed School of Mines building. Dr. Roberts' educational background was supplemented by operating and executive experience in coal mining in England and the gold fields of British West Africa. A lecture tour is being planned for him so that he may visit other mining engineering departments throughout the country.



The government of India will send a team of experts to China in the near future to study the reported increase in steel production. The purpose is to determine whether the Chinese methods of production could be adopted in India. Dr. Minu N. Dastur, a steel plant consultant who is also a member of the team, observed that technologically the Chinese method was not new to India.

The Japan Productivity Center, Tokyo, recently made necessary arrangements to send a group of non-ferrous metal mining and smelting representatives to the United States to study management; organization; productivity; operation research at mines, smelters, and refineries; mining legislation and administration incentives; and activity of the government agencies concerned with the mining industry. The members of the group are: S. Otawa, Nittetsu Mining Co.; M. Aikyo, Mitsubishi Metal Mining Co.; T. Kobayashi, Mitsui Mining & Smelting Co.; T. Tawara, Nippon Mining Co.; Y. Tsukamoto, Toyoha Mining Co.; S. Tokura, Sumitomo Metal Mining Co.; Y. Hiratsuka, Dowa Mining Co.; I. Takamatsu, Nippon Mining Co.; S. Higashi, Mitsui Mining & Smelting Co.; and M. Nishiie, Mining Bureau, International Trade and Industry Ministry. Tentative plans call for the group to visit Bunker Hill Company, The Anaconda Company, Bingham Canyon Mine of the Utah Division of Kennecott Copper Corporation, Miami Copper Company, U. S. Bureau of Mines, Gardner Denver Company, Denver Equipment Company, Utex Exploration Company, Homestake Mining Company, and the Phelps Dodge Corporation smelter.

Amado Mesta, a mining and metallurgical engineer graduate of the National University in Mexico City, Mexico, is at the Bunker Hill Company's Kellogg, Idaho plant learning the electrolytic zinc process. He works

for Comision de Fomento Minero, a Mexican commission for aiding and developing the mining industry. He has also been in Great Falls, Montana for three months, and in Anaconda, Montana for several days to study electrolytic techniques used by The Anaconda Company.

**R. W. Winson**, general manager of Rhodesian Asbestos Limited, Mashaba, Southern Rhodesia, is now at Asbestos, Quebec, Canada.

**Tom T. Heywood**, mining engineer formerly at Kuching, Sarawak, British Borneo, is now in Blackpool, Lancashire, England.

**Desmond de Villiers Oxford** was recently recalled to the Anglo American Corporation's Nchanga, Northern Rhodesia offices where he has been appointed senior ventilation engineer. He previously spent six months with the Consulting Engineer's Department in Johannesburg, South Africa.

**K. G. O'Brien** was recently awarded the James Lyster Scholarship by the directors and management of The Zinc Corporation Ltd. and New Broken Hill Consolidated Ltd., Australia. Mr. O'Brien, lecturer in Applied Chemistry at the Broken Hill Technical College, Broken Hill, Australia, will use the scholarship to aid in post doctorate research work which he intends to carry out in the United Kingdom during the next 12 months. Mr. O'Brien will spend part of the time at Northern Polytechnic, an institution in the University of London, and the remainder of the time at the University of Nottingham. Mr. O'Brien's work at Broken Hill has been concerned with molecular structure in organo-metallic compounds.

**Dr. H. C. Gunning** has been appointed consulting geologist (Rhodesia) in the Salisbury office of Anglo American Corporation of S. A. Ltd. He succeeds Dr. T. D. Guernsey, who has retired. The author of numerous government, technical and scientific publications, Dr. Gunning for a time held a post in the Geological Survey of Canada; in 1939 he was appointed professor of the University of British Columbia, Vancouver, Canada; 10 years later he became head of the Department of Geology and Geography; and subsequently was elected Dean of Applied Science.

**JOHN W. SVANHOLM**, consultant, who recently completed a second term of service with the Mineral Resources Development Corporation, Union of Burma Government in Rangoon, is presently doing work at Stockholm University in Stockholm, Sweden.

While in Burma, Mr. Svanholm directed geological-geophysical exploration and subsequent excavating and drilling, as well as evaluating mineral deposits of Burma.



**NORBERT F. KOEPEL** (left), vice president of Anaconda Company's subsidiaries, Chile Exploration Company and Andes Copper Mining Company, has been honored by the Republic of Chile. **WALTER MÜLLER** (right), Chile's new ambassador to the United States, is shown presenting Mr. Koepel with the Order of Bernardo O'Higgins in the Rank of Knight Commander. The award as presented to Mr. Koepel "is a token of our gratitude for the great work you are doing to benefit Chile and to remind you that Chilean people will always maintain your name in the honor roll of their real friends." Mr. Koepel has lived in Chile for more than 36 years and held engineering, technical and executive posts with Anaconda operations at Potrerillos, prior to moving to New York in 1955. He is a key executive in the planning of the El Salvador project near Potrerillos.

**J. Bradfield**, president of Noranda Mines of Canada, has recently visited mining operations in the Copperbelt of Rhodesia and in South Africa.

**W. S. Findlay** has been appointed a director of South African Minerals Corporation Limited, succeeding A. S. Thomas who has resigned.

**P. J. L. Crokaert** (Belgian) has been appointed director of De Beers Consolidated Mines Limited, South Africa.

**John J. Collins**, formerly associated with American Smelting and Refining Company, has been named general manager of Revere Copper & Brass Inc.'s new mining department which will develop ore sources, including bauxite. Mr. Collins has just returned to the United States from the London office of Asarco where for eight years he was the company's special representative in Europe and Africa, supervising the exploration of prospects in the Rhodesias, West and East Africa and the Portuguese colonies. Mr. Collins will make his headquarters at the Revere offices in New York City.

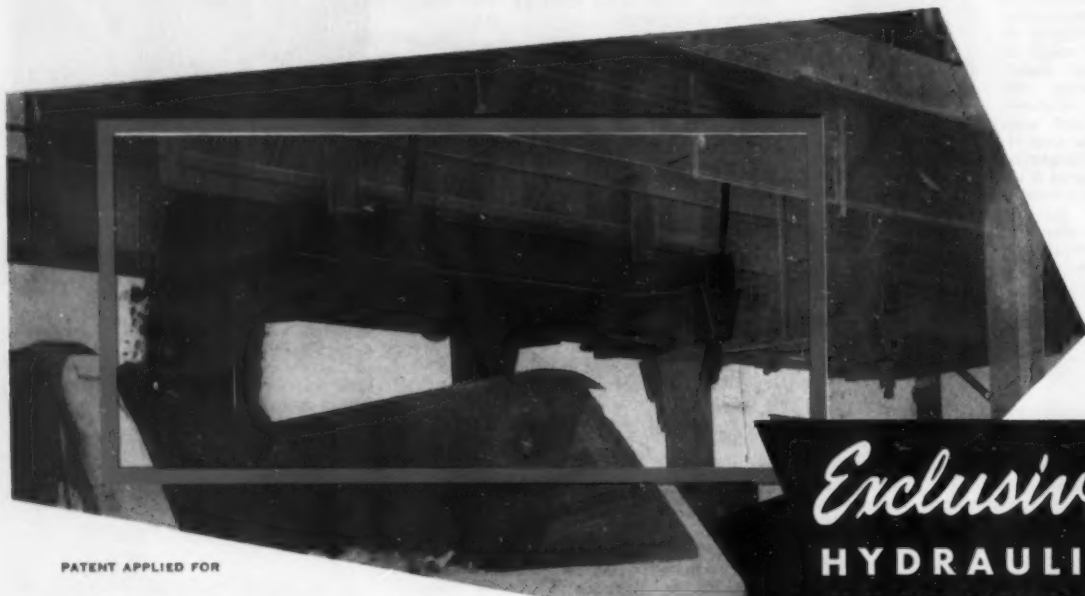
**N. W. S. Lewin**, **M. E. Rich**, and **G. V. R. Richdale** have been appointed directors of the Corner House Investing Company Ltd., South Africa.

The board of Randfontein Estates Gold Mining Company Limited, has been reconstituted as follows: **D. A. B. Watson**, chairman; **W. S. Findlay**; **F. J. L. Wells**; **I. M. Campbell Roger**; and **A. S. Thomas**. The company's headquarters are in Johannesburg, South Africa.

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American Smelting and Refining Company is deepening the main shaft of the Galena mine to the 4,000-foot depth in the silver belt west of Wallace, Shoshone County, Idaho. A rich silver-copper vein discovered on the 3,000-foot level has been followed down to the 4,000 level by winze. Production from the vein in 1958 totaled 120,000 tons of ore, averaging 35.3 ounces of silver and 1.7 percent copper to the ton. Asarco is operating the mine under long-term lease from Callahan Mining Company.

Deep in the Silver Syndicate, Inc. mine adjoining the Sunshine mine in Shoshone County, Idaho's silver belt, miners have started drifting 400 feet westerly to get under an ore shoot which yielded high grade ore on and above the 3,840-foot level. Production was 12,303 tons of ore in 1958, compared to 19,852 tons in 1957, because of a higher lead content and a lower price for lead. Sunshine Mining Company is the operating firm.

A lead-silver ore body has been found in the 73-year-old Bunker Hill mine at Kellogg, Shoshone County, Idaho. It was discovered in unexplored ground on the 11th level and followed for over 125 feet before being cut off by a fault. Following development work above that level, the Veral vein was opened for more than 625 feet on the 13th level, 400 feet below the 11th level. The vein is from 4 to 25 feet wide. Development is planned next on the 15th and 19th levels.

Silver-lead ore has been developed over a distance of 1,250 feet on the 2,600-foot level of the Lucky Friday mine east of Mullan, Shoshone County, Idaho, and for 450 feet on the new bottom 3,050-foot level, with good ore still showing in the east faces. No development has been done as yet between these levels. Lucky Friday Silver-Lead Mines Company mined a total of 55,176 tons of ore in 1958. Millheads averaged 17.4 ounces of silver, 9.5 percent lead, and 1.1 percent zinc.

A vein discovered in the footwall of the Chester fault in the eastern portion of the Sunshine mine is being developed on the 3,700-, 3,850- and 4,000-foot levels. Drifting on the vein so far totals 991 feet, of which 806 feet is in silver-lead ore. The Sunshine mine produced a total of 231,964 tons of ore in 1958 and 233,000 tons of ore were developed.

Idaho Mining and Milling, Inc. of Lewiston, Idaho has purchased a No. 2, Yuba, floating, bucket-line dredge from Rare Earths, Inc. of McCall for a gold dredging operation in Idaho County's Florence Basin. Initial work is planned on Meadow Creek, which was tested by the firm two years ago with a Yuba jig. Philip W. Jungert is president and Marion G. Jungert, secretary-treasurer.

At the Silver Mountain property two miles east of Mullan, Shoshone County, Idaho, miners are within about 900 feet of an objective from which drilling will be carried out to seek the downward extension of ore zones mined years ago at shallow depths in the old Snowstorm mine. More than 3,100 feet of tunneling and 8,600 feet of diamond drilling were done in 1958 without finding ore. Hecla

and Bunker Hill mining companies are sharing the cost of the DMEA project.

Clayton Silver Mines has started development of a new 800-foot level at its mine in Custer County, Idaho's Bayhorse district. A total of 2,000 feet of drifting to the North and South ore bodies will be done. The shaft had been deepened 300 feet. The company mined and milled nearly 25,000 tons of lead-silver-zinc ore in 1958 before suspending production September 8 because of low metal prices. A small development crew was kept on the job and production was resumed in mid-January of this year.

Callahan Consolidated Mines, Inc., has acquired the Temple group of five patented claims in the Coeur d'Alene mining region near Burke, Shoshone County, Idaho, and is acquiring two additional groups totaling 20 patented claims in the same county.

In the Shoshone County, Idaho property of Metropolitan Mines Corporation, Sunshine Mining Company is mining the Yankee Girl vein on the 3,400- and 3,700-foot levels and driving a raise between them. On the 3,700, easterly drifting has disclosed three faults which offset the vein. The drift was discontinued years ago when the vein apparently pinched out but it was resumed last fall when wall drilling showed the vein had been shifted six feet into the hanging wall by faulting.

Adams-Winston Western Syndicate of Duluth, Minnesota is planning a spring drilling program south of Potlatch in Latah County, Idaho to test showings of high-grade magnetite. Preliminary exploration was carried out previously by the firm. The company has leased land from Frank Milbert and M. L. Darrow of Potlatch, to whom the Idaho state land board has granted its first iron ore mining lease.

Atlas Engineering Corporation of Kellogg, Idaho has optioned 40 mining claims near Rock City in the Prichard area north of Wallace in Shoshone County. Diamond drilling of a mineralized structure carrying copper, gold, and silver is planned. Atlas Engineering is the operating firm for three Coeur d'Alene mining region firms—Lookout Mountain Mining and Milling Company, Caledonia Silver-Lead Company, and Highland-Surprise Consolidated Mining Company.

Development of the Black Bird and Big Blanket groups of claims in Blaine County, Idaho is planned by newly or-

ganized San Raphael Mines, Inc. Articles of incorporation filed at Hailey listed six Utahans as incorporators and Clifton S. Meyers of Bellevue as the Utah firm's authorized agent in Idaho. Capitalization was listed at \$200,000.



Bunker Hill Company of Kellogg, Idaho has acquired 1,200 acres of phosphate-bearing property near Elliston, Montana from Russell Luke of Butte. The property location starts near Snowshoe Gulch and extends almost to Elliston. Bunker Hill plans to mine the deposit for its proposed \$10,000,000 superphosphate plant.

Montana Phosphate Products Company has purchased the mine, mill, and mineral leases on approximately 1,400 acres of federal land held by International Minerals & Chemical Company of Chicago, Illinois. The mining property is located on Douglas Creek in the Flint Creek Valley near Hall. Montana Phosphate holds other leases in this area.

Montana's Land Board issued its first chrome ore prospecting lease recently. Eighty acres of state land in Madison County were included in the lease which was issued to J. D. Hammond of Dillon.

The Anaconda Company is enlarging the Alice pit at Butte, Montana to make available a substantial reserve of zinc ore. The mine formerly produced siliceous ore for converter flux from the oxidized portion of the Alice vein near the surface.

The American Chrome Company expects to add sintering equipment to its new pilot ferrochrome smelter at Nye, Montana later this year. Other changes will also be made to increase capacity to a range of about 15 to 20 tons of ferrochrome daily. Initial output has been five to six tons daily. The company has also purchased the government-owned mill building, facilities, and equipment at Nye which were being used to complete the ore concentrate supply contract. The facilities are located almost entirely on company-owned property and are presently needed in connection with the pilot smelter. During 1958, American Chrome delivered 119,057 tons of chrome concentrate to the government stockpile;

## Bear Creek Hits Uranium by Long Hole Drilling

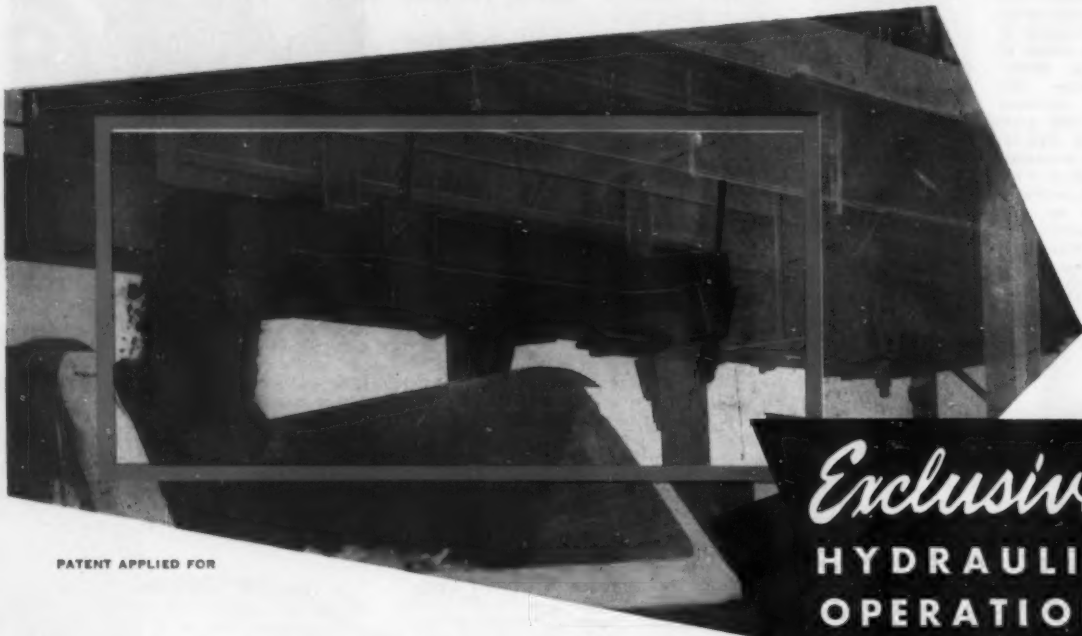
In the Mount Spokane uranium district of northern Spokane County, Washington, Bear Creek Uranium Company of Rhame, North Dakota is sinking a winze on an ore body outlined by long hole drilling from the bottom of a 100-foot shaft. The holes were drilled 60 feet into the shaft walls. Frank Birch, mining engineer, is shown (above left) drilling long holes. Oscar Herem, mine supervisor, checks drillings with "black light," at right. The Bear Creek company's operation is the first underground mining development in the Mount Spokane uranium district. The firm has shipped 600 tons of ore to the Ford, Washington, uranium processing plant and has more than 200 tons stockpiled.



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Deep in the **Silver Syndicate, Inc.** mine adjoining the **Sunshine** mine in Shoshone County, Idaho's silver belt, miners have started drifting 400 feet westerly to get under an ore shoot which yielded high grade ore on and above the 3,840-foot level. Production was 12,303 tons of ore in 1958, compared to 19,852 tons in 1957, because of a higher lead content and a lower price for lead. **Sunshine Mining Company** is the operating firm.

A lead-silver ore body has been found in the 73-year-old **Bunker Hill** mine at Kellogg, Shoshone County, Idaho. It was discovered in unexplored ground on the 11th level and followed for over 125 feet before being cut off by a fault. Following development work above that level, the Veral vein was opened for more than 825 feet on the 13th level, 400 feet below the 11th level. The vein is from 4 to 25 feet wide. Development is planned next on the 15th and 19th levels.

Silver-lead ore has been developed over a distance of 1,250 feet on the 2,600-foot level of the **Lucky Friday** mine east of Mullan, Shoshone County, Idaho, and for 450 feet on the new bottom 3,050-foot level, with good ore still showing in the east faces. No development has been done as yet between these levels. **Lucky Friday Silver-Lead Mines Company** mined a total of 55,176 tons of ore in 1958. Millheads averaged 17.4 ounces of silver, 9.5 percent lead, and 1.1 percent zinc.

A vein discovered in the footwall of the Chester fault in the eastern portion of the **Sunshine** mine is being developed on the 3,700-, 3,850- and 4,000-foot levels. Drifting on the vein so far totals 991 feet, of which 806 feet is in silver-lead ore. The **Sunshine** mine produced a total of 231,964 tons of ore in 1958 and 233,000 tons of ore were developed.

**Idaho Mining and Milling, Inc.** of Lewiston, Idaho has purchased a No. 2, Yuba, floating, bucket-line dredge from **Rare Earths, Inc.** of McCall for a gold dredging operation in Idaho County's Florence Basin. Initial work is planned on Meadow Creek, which was tested by the firm two years ago with a Yuba jig. Philip W. Jungert is president and Marion C. Jungert, secretary-treasurer.

At the **Silver Mountain** property two miles east of Mullan, Shoshone County, Idaho, miners are within about 900 feet of an objective from which drilling will be carried out to seek the downward extension of ore zones mined years ago at shallow depths in the old **Snowstorm** mine. More than 3,100 feet of tunneling and 8,600 feet of diamond drilling were done in 1958 without finding ore. Hecla

and **Bunker Hill** mining companies are sharing the cost of the DMEA project.

**Clayton Silver Mines** has started development of a new 800-foot level at its mine in Custer County, Idaho's Bayhorse district. A total of 2,000 feet of drifting to the North and South ore bodies will be done. The shaft had been deepened 300 feet. The company mined and milled nearly 25,000 tons of lead-silver-zinc ore in 1958 before suspending production September 8 because of low metal prices. A small development crew was kept on the job and production was resumed in mid-January of this year.

**Callahan Consolidated Mines, Inc.**, has acquired the Temple group of five patented claims in the Coeur d'Alene mining region near Burke, Shoshone County, Idaho, and is acquiring two additional groups totaling 20 patented claims in the same county.

In the Shoshone County, Idaho property of **Metropolitan Mines Corporation**, **Sunshine Mining Company** is mining the **Yankee Girl** vein on the 3,400- and 3,700-foot levels and driving a raise between them. On the 3,700, easterly drifting has disclosed three faults which offset the vein. The drift was discontinued years ago when the vein apparently pinched out but it was resumed last fall when wall drilling showed the vein had been shifted six feet into the hanging wall by faulting.

**Adams-Winston Western Syndicate** of Duluth, Minnesota is planning a spring drilling program south of Potlatch in Latah County, Idaho to test showings of high-grade magnetite. Preliminary exploration was carried out previously by the firm. The company has leased land from Frank Milbert and M. L. Darrow of Potlatch, to whom the Idaho state land board has granted its first iron ore mining lease.

**Atlas Engineering Corporation** of Kellogg, Idaho has optioned 40 mining claims near Rock City in the Prichard area north of Wallace in Shoshone County. Diamond drilling of a mineralized structure carrying copper, gold, and silver is planned. **Atlas Engineering** is the operating firm for three Coeur d'Alene mining region firms—**Lookout Mountain Mining and Milling Company**, **Caledonia Silver-Lead Company**, and **Highland-Surprise Consolidated Mining Company**.

Development of the **Black Bird** and **Big Blanket** groups of claims in Blaine County, Idaho is planned by newly or-

ganized **San Raphael Mines, Inc.** Articles of incorporation filed at Halley listed six Utahans as incorporators and Clifton S. Meyers of Bellevue as the Utah firm's authorized agent in Idaho. Capitalization was listed at \$200,000.



**Bunker Hill Company** of Kellogg, Idaho has acquired 1,200 acres of phosphate-bearing property near Elliston, Montana from Russell Luke of Butte. The property location starts near Snowshoe Gulch and extends almost to Elliston. **Bunker Hill** plans to mine the deposit for its proposed \$10,000,000 superphosphate plant.

**Montana Phosphate Products Company** has purchased the mine, mill, and mineral leases on approximately 1,400 acres of federal land held by **International Minerals & Chemical Company** of Chicago, Illinois. The mining property is located on Douglas Creek in the Flint Creek Valley near Hall. **Montana Phosphate** holds other leases in this area.

Montana's **Land Board** issued its first chrome ore prospecting lease recently. Eighty acres of state land in Madison County were included in the lease which was issued to J. D. Hammond of Dillon.

The **Anaconda Company** is enlarging the Alice pit at Butte, Montana to make available a substantial reserve of zinc ore. The mine formerly produced siliceous ore for converter flux from the oxidized portion of the Alice vein near the surface.

The **American Chrome Company** expects to add sintering equipment to its new pilot ferrochrome smelter at Nye, Montana later this year. Other changes will also be made to increase capacity to a range of about 15 to 20 tons of ferrochrome daily. Initial output has been five to six tons daily. The company has also purchased the government-owned mill building, facilities, and equipment at Nye which were being used to complete the ore concentrate supply contract. The facilities are located almost entirely on company-owned property and are presently needed in connection with the pilot smelter. During 1958, **American Chrome** delivered 119,057 tons of chrome concentrate to the government stockpile;

## Bear Creek Hits Uranium by Long Hole Drilling

In the Mount Spokane uranium district of northern Spokane County, Washington, **Bear Creek Uranium Company** of Rhame, North Dakota is sinking a winze on an ore body outlined by long hole drilling from the bottom of a 100-foot shaft. The holes were drilled 60 feet into the shaft walls. Frank Birch, mining engineer, is shown (above left) drilling long holes. Oscar Herem, mine supervisor, checks drillings with "black light," at right. The **Bear Creek** company's operation is the first underground mining development in the Mount Spokane uranium district. The firm has shipped 600 tons of ore to the Ford, Washington, uranium processing plant and has more than 200 tons stockpiled.





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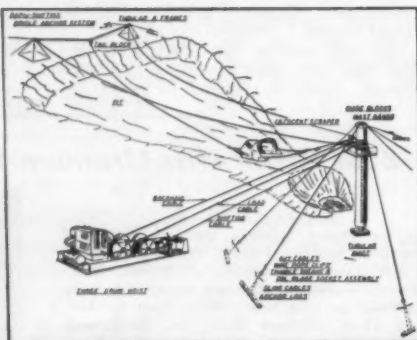
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## NORTHWEST

114,298 tons had been delivered in 1957. Balance still remaining under the three-year contract with the General Services Administration is 294,356 tons.



The secondary uranium minerals in the **White King mine of Lakeview Mining Company** at Lakeview, Oregon have now been officially described as heinrichite and metahainrichite. They had been previously reported to be autunite, novacekite, and/or lakeviewite. Heinrichite and metahainrichite, named for Professor E. William Heinrich of the University of Michigan, are found near the surface at the White King. They are also evident in the Black Forest of Germany.

Commercial production of mercury has started at the quicksilver property of **Western Minerals Inc.** at Quartz Mountain in Lake County, Oregon. The firm has been installing equipment for some time, and finally went into regular commercial production on March 31, although 28 flasks had been produced during test operations. The plant recovers 97 percent of the quicksilver in the ore, and average recovery is five pounds per ton of ore. John Kentie is plant manager and Marvin Weatherly is superintendent of operations.



**Mount Baker Mining and Milling Company** is completing a mill on the Mount Baker highway near Maple Falls, Whatcom County, Washington, to handle ore from the **Verona** mine, which was worked for gold many years ago. Open-pit mining methods are planned. The mill also will do custom milling. **H. V. Vic Carson** of Bellingham is company president.

A 75-foot, two-compartment shaft is being sunk in the Mount Spokane uranium district of Washington by **Mudhole Exploration, Inc.**, to open a mineralized zone found by percussion drilling. Holes were put down to depths of up to 150 feet, with high-grade autunite indicated at about the 40- and 60-foot horizons. The location is two miles southwest of **Hanson** lease stripping operations from which 350 tons of ore was shipped last fall. Radioactive springs led to the discovery. Frank E. Birch, Spokane mining engineer, is directing the work.

Extensive prospecting of the old Electric Point mine in Stevens County Northport mining district is planned this season. Leasing operations last year yielded \$8,000 worth of high-grade lead ore. The property, at one time Washington's leading lead producer, now is owned by Northwest Mining Syndicate. Fred M. Viles of Spokane is managing director.

Resumption of development work at properties in the Mount Spokane and Orient districts of Washington is planned for this spring by **Painted Desert Uranium and Oil Company**. Willard H. Parsons of Worley, Idaho is president, and William M. Fredericks of Spokane is secretary-treasurer.

## Inspiration To Bring Mine Into Production

With a further investment of \$16,000,000, Inspiration Consolidated Copper Company will go ahead with development of the Christmas mine near Wickenburg, Arizona. The mine should be ready for production within three years, but a flexible program allows for acceleration or suspension of the project according to changing market conditions.

Plans call for production of 4,000 tons of ore daily, or some 36,000,000 pounds of copper per year. Proved and probable ore reserves at the Christmas mine are estimated at 20,061,625 tons averaging 1.83 percent copper having a recoverable copper content of 6,000,000 pounds. At the planned production rate, the mine is expected to operate for a minimum of 20 years.

During the last half of 1958, the development shaft was deepened to the 1,600 level, which will be the main haulage level. (See MINING WORLD, December 1958, page 58.) Currently, the company is running metallurgical tests to determine the best extraction method. Bruce B. Whitney is general superintendent for Inspiration at the Christmas mine.

The company reports that its mine at Inspiration is now producing at a rate of about 17,500 tons of ore per day, highest daily tonnage since the advent of open-pit mining at Inspiration. Total ore tonnage in 1958 was 4,621,091 tons with 1.18 tons of waste for each ton of ore mined. Inspiration produces 15.6 pounds of copper for each ton of ore treated.

## Arizona's Tenth Cu Pit High in Mechanization

Now in production at the rate of 12,000 tons per day is the Esperanza mine in the Sierrita Mountain foothills 30 miles south of Tucson, Arizona. Owned by the Duval Sulphur and Potash Company, it is the state's tenth, and one of the most highly mechanized open-pit mines and flotation mills.

More than three years and \$20,000,000 have gone into development of the mine and construction of the mill since Duval acquired the 90 lode claims, following extensive exploration work. More than 5,500,000 tons of overburden were stripped to expose the estimated 49,000,000 tons of ore averaging 0.75 copper.

The mill reportedly has more automatic equipment than any other copper mill in the state and contains the largest Marcy rod mills in the industry. Concentrates are shipped by rail to Hayden, Arizona, for smelting. Mining operations are conducted on a six-day week basis, with continuous milling operations. The oval pit is to measure 3,600 by 2,800 feet, going to a depth of 200 feet below the base of the hill. Life expectancy of the mine is 12 years.



American Smelting and Refining Company reports that additional drilling has further confirmed previous estimates of copper ore at the Mission Project, formerly known as the East Pima Project,

near Tucson, Arizona. A 375-foot shaft was sunk in the east section of the proposed open pit, and bulk samples for mill tests were provided. This work permitted a study of the depth behavior of the deposit, which is overlain with 200 feet of sand and gravel. Metallurgical tests conducted on the drill cores from various sections of the deposit showed excellent copper recoveries.

William F. Kelsey and Associates of Wickenburg, Arizona are opening the Abe Lincoln copper and gold property in Yavapai County, 14 miles northeast of Wickenburg. Some shipments have been made to the Miami Copper Company, and the firm hopes to achieve a regular rate of 300 tons per week soon. An ore bin has been completed for storage. The mine was first opened in 1902 as a silver, gold, copper producer. It was last active in the late 1920's. Mr. Kelsey and his group have reopened 1,400 feet of the adit, cleaning and retimbering under the stope. They have also done about 300 feet of crosscutting to the southeast. The first stope is 137 feet from the portal, and they are now opening up the fourth stope. Each is 75 to 100 feet long. The back over the first stope is 100 feet and the others average about 175 feet. A fifth stope will be opened in a crosscut 400 feet from the portal, and this will have about 200 feet of backs. There is a 900-foot-deep shaft on the property, but this is not yet serviceable.

Grimes and Brunson of Tonto Basin, Arizona, are stripping the overburden along two sides of the pit on the Bernice claim of the McGee mercury group. The work is being done to provide immediate ore requirements of the Rattlesnake mill while a tunnel is driven to get under the main ore body. The Rattlesnake mill was shut down for a short period early in February while an ore stockpile was built up. Prior to that, production had been running at the rate of about a flask of quicksilver daily.

Preparations for mining and shipping a high silica flux ore are underway at the Homestake claim, nine miles southwest of Patagonia, Arizona. The claim is owned by Floyd R. Bekins of Los Angeles. Joe Banta of Nogales, Arizona, will direct the work at the mine under agreement with Bekins. Old workings at the property consist of four adits, ranging up to 60 feet in length, and the initial underground work will be started in these adits.

The Buckeye Mica Company, H. G. Smith, manager, Buckeye, Arizona, is handling 250 to 300 tons of mica a month, the product going mostly to the roofing industry. Four men are employed at the mine and two at the mill.

Lew Smith of Blythe, California, manager of Western Milling Company, reports that four new jigs were installed at the Western manganese mill and that operations are running at the rate of 700 tons per day. The ore comes from the Black Jack, M & A, and Black Diamond mines in the Cibola district of Arizona. Fines from the operation are sintered at the Riplev, California, sinter plant, now operated by Giant Resources Corporation of Salt Lake City, Utah, which acquired the plant from Western. Roland Young is superintendent of the sinter plant. Wells Cargo holds the contract for hauling the Western ore from mine to mill, and also for hauling the concentrates.

The Metate 4 and five other claims in the Dome Rock Mountains of Yuma

County, Arizona, have been leased by McFarland and Hullinger. A 50-foot shaft has been sunk to the manganese ore bed, and mining of the deposit will be by underground methods.

Arnev, Inc., E. G. Stevenson, foreman, Parker, Arizona, is stripping overburden from a promising manganese discovery five miles east of the Ambrosia mill at Aguila. The claims are the Valley View and Valley View Extension. Plans call for a production of 200 tons of ore per day with the ore expected to run from 10 to 20 percent Mn. Ore will be treated at the Ambrosia mill.

The partnership of Crawford and King of Vicksburg, Arizona, is rehabilitating the old Yuma copper mine, and is said to be planning deep exploratory development. Considerable equipment has been moved in, and a crew of four men is employed installing track, air lines, hoist, etc., as the first step in the program.

Mining and milling operations at the Black Bird mine at Bouse, Arizona, are continuing at a normal rate with the mill handling 600 tons per day of manganese ore. Mining and stripping are in progress in the northwest pit area. Pat DeWilliams is resident manager, directing the work for Sunshine Mining Company.

The Bald Eagle Mining Company is employing a crew of seven men at its gold property in the San Francisco mining district of Mohave County, Arizona. The shaft is being sunk at the 125-foot level, following retimbering and repair work. Quincy Crain, Sr., is president; Quincy Crain, Jr., superintendent. Offices are located in Bullhead City, Arizona.

The Western Metals Corporation of Dallas, Texas, has taken over the plant and operations of Metals Concentrating Company at the old Vulture tailings, Wickenburg, Arizona. W. D. Threlheld is in charge. The project is being carried on under the new name by the heirs and associates of the late J. W. Crotty of Dallas who started the venture in 1957.

Shaft sinking is in progress at the Santo Nino mine in the Duquesne district of Santa Cruz County, Arizona, and a depth of more than 75 feet has been attained. The shaft work was undertaken by W. S. Talcott of Nogales, Arizona, the lessee, following about 400 feet of diamond drilling. Three men are employed. The principal ore values are in copper with some molybdenum.

The old shaft at the Silver Ray mine in the Arivaca mining district of Pima County, Arizona, has been retimbered to a depth of 230 feet, and work is continuing with three men employed, five days a week. The shaft is two compartments, five by nine feet. The Silver Ray, located about seven miles northeast of Arivaca, carries principal values in copper and silver. It is owned by Walter Bopp of Tucson. C. L. Jarnegin, Arivaca, is mine foreman.



An iron deposit has been discovered on the west slope of Twin Peaks in San Francisco, California by Standard Building Company during construction of a tract of homes. Assays are reported to have

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## MINING WORLD



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confirmed the presence of iron, and numerous other metals. Because there is a law against mining in the city, no development of the deposit will be undertaken.

Natomas Company had three dredges in operation in the Folsom district of California last year, handling 2.8 percent less yardage than in 1957, but producing practically the same gross amount of gold. Total operating costs were slightly lower, reflecting curtailment resulting from the closing down of one unit in 1957. During 1958 the firm dredged 13,055,313 cubic yards, compared with 13,435,762 in 1957. Gross returns per yard were 9.15¢ in 1958 and 9.01¢ in 1957. Because of the declining importance of domestic gold dredging, programs of mineral exploration have been undertaken and are continuing in several foreign countries.

Kaiser Steel Corporation's new \$214,000,000 expansion, coupled with strong pickup in demand, has enabled the firm to set all-time production records. March output at the Fontana, California plants totaled 185,000 ingot tons, which included 51,000 tons of steel from the new oxygen steelmaking facilities. The plant is currently operating at about 80 percent of its new rated capacity. Kaiser's production capacity was doubled to nearly 3,000,000 ingot tons annually when the new expansion facilities were placed in operation late in 1958.

American Potash & Chemical Corporation is building the first large-scale commercial plant for the production of boric oxide. The new \$800,000 facilities will be installed at the main plant of American

Potash at Trona, California. Production is scheduled to start late this year. The Trona plant's production capacity for boric acid will also be increased, since it is the starting material in the manufacture of boric oxide. The latter is used in high-energy fuels as well as in various industrial applications.

The California Division of Mines is offering an interesting publication called "Plants as a Guide to Mineralization", which describes a technique of biogeochemical prospecting that is relatively new. It is a rapid, inexpensive method of prospecting that may become an important adjunct to the systems now used in determining locations of deposits. The biogeochemical prospecting technique consists in sampling, analyzing, and interpreting plant cover to determine its relationship to buried ore deposits.



Nevada Mines Division of Kennecott Copper Corporation has set up a pilot operation in its molybdenum plant to improve the separation of molybdenum and copper. Until the present time the molybdenum sulfide in the ore was floated out with the copper. The combined concentrate was then treated with steam to break down and destroy the reagents which caused the minerals to float. This de-ac-

tivated concentrate was then floated again and a new reagent added which depressed the copper and allowed only the molybdenum to float. Thus the moly was separated from the copper and could be collected, packaged, and shipped. By the use of a new reagent to depress the copper more thoroughly, by allowing more time for the process, and by the use of a different flotation machine, the research group has been able to come up not only with a greater recovery, but also with a cleaner concentrate. However, exact results will not be known until all tests are completed.

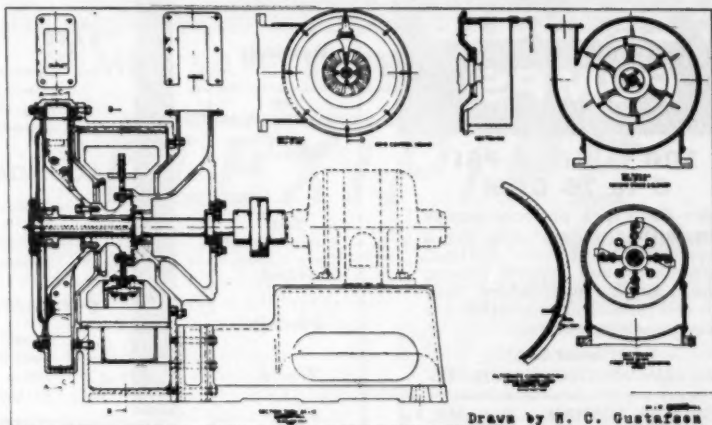
Two prospectors exploring a manganese claim in Nevada, about 28 miles southwest of Ely, have discovered high alumina-like material. Ullis Stewart and Rocky Pastorino made the find. Much of the material appears to be low in grade, but the two expect to develop the property further this spring.

Research has enabled Manganese Inc., which operates the Three Kids mine near Henderson, Nevada, to improve its process so that it may be able to treat lower grade ores profitably. A mill test has been completed and if future mill size tests are successful it will extend the life of the property and enable the firm to operate throughout 1959. Previously the firm had expected to close in 1958. It produces metallurgical grade manganese nodules for the government stockpile.

Fibreboard Paper Products Corporation plans construction of a new plaster mill and a 60 percent increase in gypsum board capacity at its South Gate, California gypsum plant because of a vast

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gypsum deposit located near Apex, Nevada. The deposit is estimated to contain 750,000,000 tons of high-grade gypsum rock, with no overburden, so that mining costs would be low.

Carl and Gene Reinecke of Littlerock, California have purchased several claims on the east slope of the Toiyabe Range, south of Park Canyon, Nevada. One is the Gold Pocket mine, containing mainly gold and silver, which was acquired from Lou and Phil Myers. The adjoining claim was purchased from Kenneth Rodgers of Sparks. Work will be started later this spring.



Section 10 mine of Kermac Nuclear Fuels Corporation, near Grants, New Mexico, is now mined out. Sections 22 and 30 are in production, and Section 24 has mined its first ore from development work. In Section 33 mine, the shaft has been completed and some construction work is still being carried out. This will be the next Kermac mine to go into production. Section 12, the deepest of the Kermac operations, has completed its shaft at 1,010 feet, and undertaking lateral development.

St. Anthony Uranium Corporation is reopening its uranium mine for full-scale production after being closed down for

about a year. The mine is on the Cebolleta land grant in Sections 29 and 30 of Valencia County, New Mexico. The company is a wholly owned, unconsolidated subsidiary of American Metal Climax Inc. Arrangements were recently completed for sale of the ore for milling.

Sunshine Mining Company has not yet decided whether to proceed with underground exploration of a group of lead-barite-fluorspar claims southeast of Socorro, New Mexico. Preliminary field mapping, sampling, and drilling have been completed but results to date have not been conclusive.

Having exhausted the ore discovered in 1957 on its farmout on Sec. 36, T. 14 N., R. 10 W., in New Mexico's Ambrosia Lake district, Vanadium Corporation of America has terminated its lease arrangements. The agreement had been with United Western Minerals and its farm-out group.

Two health authorities have commented that the uranium miners in New Mexico have the safest working conditions, as far as radiation exposure is concerned, of the eight uranium producing states in the U.S. Dr. Carl R. Jensen of the State Health Department, and Dr. Duncan H. Holaday of the U.S. Public Health Service in Salt Lake City reportedly made the observation because of recent subcommittee hearings in Washington, D.C. on radiation hazards and workmen's compensation rules for atomic installations.

The U.S. Atomic Energy Commission has detonated several deep explosions

near Carlsbad, New Mexico, in Project Gnome, trying to determine whether a planned underground atomic shot will damage potash mine and oil wells. The atomic explosion, planned for next fall, will be in the range of 10 kiloton, equal to 10,000 tons of TNT. Another explosion is planned to make the hole large enough to hold the 10 tons of TNT in the final test before the nuclear device is set off.



Although the Atomic Energy Commission has contracted to purchase uranium ore produced by San Antonio Mining Company in southern Texas, mining operations have been postponed at the request of the Commission. The firm is a wholly owned, unconsolidated subsidiary of American Metal Climax, Inc.

The Texas City smelter being operated by the Wah Chang Corporation has received shipments of tin ore from Indonesia and Thailand. The Thai government reportedly had been studying the possibility of bartering tin for U.S. surplus agricultural products, and it is possible such shipment could be made outside their regular export quota.

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## precipitates—ROCKY MOUNTAIN



Work is well underway in the Silverton, Colorado area where **Shenandoah Limited** (formerly **Marcy-Shenandoah Corporation**) hopes to start custom milling in June. The Shenandoah mill is being reopened to treat custom ore and supplemental ore from the **Shenandoah** mine. An additional circuit will also be installed to handle ore from **Sunnyside** mine which contains rhodonite. The 1,000-foot aerial tram from mill to the Shenandoah mine is making trial runs. The Letter G vein is to be developed through the Silver Lake crosscut originally driven to veins leased from **American Smelting and Refining Company**. Progress is being made in the **American Tunnel** of the **Gold King** mine where a concrete portal has been poured, tracks are being relaid and widened, and caves are being cleaned up. The tunnel will then be extended to the Washington vein of the **Sunnyside** mine, leased from **U.S. Smelting Refining and Mining Company**. **Al Freeland** still has a sublease on another part of the **Gold King** mine.

**Pinnacle Exploration Inc.** is currently exploring a section of its **Indian Creek** property near **Gunnison**, Colorado which it will call **Pitch** mine. The **Pitch Tunnel** is being driven 850 feet to intersect and open up a mineralized area indicated by diamond drilling. Drill cuttings of uranium ore found in this area show a very high lime content. The **Cotter Corporation's** mill at **Canon City**, Colorado, about 100 miles away, is able to treat this type of ore and so a preliminary contract for treatment of 500 tons per month has been arranged with them. In the **Akron** area, prospects are still good for a lead-zinc operation, and more exploratory diamond drilling will be done this summer. **Pinnacle** is a subsidiary of **Callahan Mining Corporation**.



**Pinnacle Exploration, Inc.**, subsidiary of **Callahan Mining Corporation**, will continue to explore in the **Cryptoprospect** area of **Juab County**, Utah this season. Geophysical crews last summer developed both magnetic and electromagnetic anomalies in that area.

**New Park Mining Company** has completed most of its preliminary work preparatory to driving a 6,000-foot exploration drift in its **Mayflower** mine in the **Park City** district of **Utah**. The firm has a \$715,185 **DMEA** loan and will seek copper ore indicated in ediments on the 2,000-foot level of the property.

**Vitro Uranium Company** will continue its investigations this year into suitable sources of raw materials for its **Salt Lake City**, Utah custom mill. A wholly owned subsidiary, **Uranium Prospectors Company Ltd.**, was liquidated into the division but ore development operations in the **Green River**, Utah area will continue. **Vitro Uranium**, which is a division of

**Vitro Corporation of America**, converted its solvent extraction plant to an amine circuit which is expected to improve the product and bring about lower operating costs.

**Chief Consolidated Mining Company** of **Eureka**, Utah and **Shattuck Denn Mining Corporation** of **New York** are reported to have reached an agreement about merging the two firms. No further details are available at this time.

**Utah Copper Division of Kennecott Copper Corporation** has found it necessary to lower the ore grade from its **Utah** mine in **Bingham Canyon**, Utah. Until now, the average assay on all ore entering the mills was set at 0.82 percent Cu; this will be reduced to 0.81 percent, re-

sulting in a loss of 5,800,000 pounds of copper in 1959 since present milling rate is about 90,000 tons of ore daily.

Additional drilling at the **Stevens Canyon** uranium mine of **New Verde Mines Company** in **San Juan County**, Utah last year added little to the small ore reserves established by previous drilling. The property is held under lease by **New Verde** and no plans for production have yet been formulated.

**Homestake Mining Company** believes that there is sufficient uranium ore in the ground at the **La Sal** mine in the **Big Indian District** southeast of **Moab**, Utah for another three years of operation. The property is owned by **La Sal Mining & Development Company** whose stock is

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## ROCKY MOUNTAIN

held by Homestake. The mine produced 61,143 tons of ore with a grade of 0.43 percent  $U_3O_8$  in 1958. The North Alice mine, also in the Big Indian district, held by Homestake under a lease and option agreement, produced 50,541 tons averaging 0.22 percent  $U_3O_8$  in 1958.

The Royal mine in the Indian Creek mining district of San Juan County, Utah has been sold by the Royal Corporation to the Security Uranium and Oil Company Inc. of Blanding, Utah. Although the mine has not been in operation for the past two years, it had produced vanadium and uranium ores when the Boyles Brothers Drilling Company operated it. The property is being reactivated by the new owners and production is scheduled to resume soon.



Ground has been broken by Western Knapp Construction Company for erection of the new \$3,000,000 uranium plant for Federal Uranium Corporation, Radorock Resources, and Gas Hill Uranium Company. Located about 50 miles east of Riverton, Wyoming, the 522-ton-per-day plant will process custom ore as well as ore from deposits owned by Federal and its associates. Completion is scheduled for December.

Phelps Dodge Corporation has started development of its Green Mountain uranium property in Wyoming. Quad Construction Company has contracted to drive a 450-foot drift into some ore in the southeast corner of Section 16. This is close to the operation of Continental Materials Corporation and probably in the same ore trend. The Phelps Dodge operation is actually handled through Green Mountain Uranium Corporation which was set up by Phelps Dodge and Wyoming Uranium Corporation. It is planned to have the mine ready to go into production early in the third quarter of this year. Ore from the mine has been assigned to the Western Nuclear Corporation mill at Jeffrey City.

Rissler and MacMurray of Casper, Wyoming have a contract from Western Uranium Corporation of Belle Fourche, South Dakota to strip about 350,000 yards of overburden from an extension of the firm's open-pit uranium mine in the east Gas Hills of Wyoming. In the original pit, 250,000 yards of overburden were removed. The original pit was 115 feet deep, and now will be 170 feet deep when stripping and mining are completed. The firm expects to go underground from this new pit in a few months.

Vitro Minerals Corporation and Jen, Incorporated are jointly exploring five properties in the Shirley Basin area of Wyoming, about 35 miles south of Casper. The properties, totalling 110 claims, are considered likely uranium-bearing areas. Vitro completed about 142,000 feet of exploratory drilling in Wyoming last year to outline further known ore bodies and to prospect in new areas. Some claims were abandoned and others acquired for future exploration. The company now holds a total of over 290 claims, either owned, leased, or held under option, in addition to the work with Jen.

## Western-Knapp To Sink Shafts for Gypsum Mine

The United States Gypsum Company has awarded an underground development contract to the Western-Knapp Engineering Company of San Francisco, California. The gypsum mine, at Sperry, Iowa, is expected to be ready for operation in December.

The contract calls for the sinking of two vertical shafts, as well as the initial mine development work at the mining level. It includes also the purchase and erection of the headframe on the hoisting shaft, installation of the underground ore pocket, and installation of crushing, mining, ventilating and skip-loading equipment.

Project managers are J. E. Edmunds for Western-Knapp, and Allen Drachman for United States Gypsum Company. Representing U.S. Gypsum in the field are Paul Lyons, resident engineer, and Bert Savoldelli, resident mine engineer.



The joint prospecting work carried out by American Zinc, Lead & Smelting Company and Granite City Steel Company in the Bourbon and Boss-Bixby areas of Missouri has been most encouraging. Although looking primarily for iron mineralization, the drilling has disclosed promising signs of copper mineralization. Out of a total of 12 holes completed on about 5,000 acres under lease and option, three give promise of a commercial grade of copper ore with thicknesses up to 100 feet. Four holes were promising, and five were classified as shine holes. All holes have shown iron mineralization. The drilling program is continuing.

Ozark Ore Company, subsidiary of M. A. Hanna Company, shipped 220,000 tons of iron ore concentrate from its underground mine at Iron Mountain, Missouri in 1958, and plans to produce about 240,000 tons this year. The Missouri Pacific Railroad hauls the ore to the blast furnaces of Granite City Steel Company at Granite City, Illinois.

The Little Wolf Mining & Mineral Company, Inc. at Big Falls, Wisconsin is reported to be considering installation of a uranium separation mill at its claims in Big Falls. George Friedrich, president of the firm, and his associates test drilled the property and outlined the general extent of the deposit last year, after four years of prospecting. Another series of drillings are scheduled for this season. Denver Equipment Company has been preparing a flowsheet for the firm. The deposit is said to lie on the southeast flank of the Canadian Shield.

A new metallurgical process for fabricating tungsten has been announced by Fansteel Metallurgical Corporation of North Chicago, Illinois. The method enables the firm to deep-draw, extrude, and spin tungsten which, until now, was not possible because of the high melting point of the metal. It should have wide application in the development of missiles and space vehicles.

The Nationwide Leasing Company of Chicago, Illinois is offering what it calls "a flexible way to expand and modernize

without capital investment." For a monthly sum, the firm leases a certain amount of equipment for a three-, four-, or five-year term. The Package Lease Plan permits large and small companies to acquire \$10,000, \$25,000, \$50,000, or more in equipment which would be repaid in single monthly payments.

The Missouri State Highway Commission has tentatively approved a location for the access road to the Pea Ridge mine of Meramec Mining Company. The tentative route will start north of Sullivan, Missouri, at an interchange to be located on Highway 66, and will run eastward along the present Highway 114 through the center of Meramec State Park to a point about one mile downstream from the present bridge, and will generally follow the present Highway 114 to the mine site. A year or more will be necessary for surveys and plans.



New Jersey Zinc Company's mine at Friedensville, Pennsylvania is expected to reach full-scale production by the middle of this year. Production started in January 1958 and has been steadily increasing. Zinc concentrates are shipped by truck to the smelter at Palmerton, about 25 miles away.

The General Services Administration is seeking proposals to convert molybdenite to molybdic oxide. When completed, the oxide is to contain 6,000,000 pounds of molybdenum. The molybdenite is now held in the national stockpile; its conversion is part of a program for converting substantial quantities of stockpiled materials into higher use forms. Write to George K. Castro, Defense Materials Services, GSA, 18th and F Streets N.W., Washington 25, D.C. before May 14.

The titanium-bearing sands near Lakehurst, New Jersey which were leased by American Smelting & Refining Company for exploration, have now been purchased by the firm. Ore dressing test work produced a high quality ilmenite concentrate. Additional studies are required, however, before steps will be taken to equip the property for production.

Republic Steel Corporation is seeking permission from the Zoning Board of Adjustment for the City of Birmingham, Alabama to mine at its Red Mountain property east of Green Springs Highway. The firm's Spaulding mine, located west of the highway, has been operating for several years. Republic has applied to have the property rezoned to heavy industrial in order that it may strip mine. The property had been zoned heavy industrial before it was taken into the city in 1953, when it was rezoned as A-residential. Residents in the area have protested the rezoning, although Republic has offered the city a 500-foot "buffer" strip around the northern end of the property for use as a park. The company may now seek a "use variance" to mine "under the control of the zoning board."

As expected, Foote Mineral Company of Kings Mountain, North Carolina has reduced its rate of lithium production with the completion of its AEC contract.

Changes have been made in the processing plant to recover mica and ceramic spodumene. The firm is presently recovering mica in its deposit and the research department has successfully demonstrated to the firm's management that it is possible to recover other valuable byproducts from the ore. It is expected that eventually these industrial minerals will be sold in large quantities.

New Jersey Zinc Company has added two more diamond drills to its DMEA-financed exploration project east of Strawberry Plains, Tennessee. Most observers think this increased drilling is due to a desire on the part of the firm to completely drill the area before the project completion date arrives, rather than the discovery of new zinc ore bodies. Most of the zinc found in this area occurs as lead-free sphalerite in the Kingsport Formation.

The W. S. Moore Mining Company of Duluth, Minnesota is reported to still be interested in magnetite iron ore bodies in the area around the Benson mines of Jones & Laughlin Steel Corporation near Newton Falls, New York. The firm has been investigating this area since 1956 and now has picked up its mining rights option on land owned by the Newton Falls Paper Mill Inc. Under terms of the option, the paper company would receive royalty payments from any ore mined.

The Austin Company of Cleveland, Ohio has established a new Mining and Metals Division to provide specialized service to mining, concentrating, and primary metal producing and processing industries. Harry E. Eiber, Austin vice president, has been named general manager of the new division.

Alan Wood Steel Company's new \$3,500,000 iron powder plant is nearing completion at Conshohocken, Pennsylvania. The plant is a result of an eight-year research program to develop a process for manufacture of high quality iron powder. In 1958, the firm produced 505,000 tons of ingots, compared with 656,000 tons in 1957, and operated at about 63.2 percent of rated capacity, compared with 60.6 percent average for the steel industry as a whole.

A recent government survey indicates that consumption of nickel in the United States this year may reach between 95,000 and 100,000 tons, as compared with 80,000 tons in 1958.

The geophysical department of Newmont Exploration Ltd., a wholly owned subsidiary of Newmont Mining Corporation, is developing two new modifications of geophysical exploration apparatus of its own invention, one utilizing the pulse potential method and the other the electromagnetic method, which will be used shortly at properties in which Newmont has an interest. The department is located in Danbury, Connecticut.



The Zenith mine which has been idle since early last summer is being reopened by a new firm, Zenith Mining Company. Participants in the new firm are North Range Mining Company of Negaunee, Michigan and W. S. Moore Company of Duluth. They have exercised their option



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## CENTRAL AND EASTERN

to lease this former Pickands Mather & Co. producer. A contract has been let to Abe W. Mathews Engineering Company to construct washing facilities at the mine near Ely, Minnesota. Current plans include straight washing facilities at the rate of 200 gross tons per hour. At least 50 percent of the underground ore will be beneficiated before shipment. Reactivation of the property reportedly is based primarily on repeal of the underground ore stockpile tax by the State of Minnesota.

Pittsburgh Pacific Company, Zontelli Division, plans to ship ore from the Virginia Concentrator near Trommold, Minnesota, Cuyuna Range. Ore from the Mangan-Joan mines will be treated in 1959. This plant was inactive during 1958. It has also been announced that stripping work will commence on the Badger mine, Menominee Range, Florence, Wisconsin. Reactivation of the mine is scheduled for early 1959. Shipments will also be made from the Meress mine, adjacent to the Badger.

The Erie Mining Company has acquired the old Pacific mine northeast of Aurora, Minnesota. The Northern Pacific Railway Company owns the fee for the Pacific mine which produced shipping ore before that type of ore was mined out leaving only taconite reserves which are of interest to Erie because of its taconite mill.

Quincy Mining Company has reopened its copper smelter at Ripley, Michigan but will not begin smelting of stockpiled concentrate from the company's reclamation plant at Mason before June first. The higher price of copper permits smelter reopening but plans have been made to build up a minimum concentrate supply to keep No. 5 furnace operating for a minimum of three months once smelting starts. John W. Chynoweth is superintendent.

The Snyder Mining Company started rock stripping at its Webb and Whiteside mines on the Mesabi Range in early March in preparation for the ore shipping season. The company also increased its work schedule from four to five days at the Webb open pit at Hibbing, the underground Godfrey mine at Chisholm, and the Whiteside open pit at Buhl. The Godfrey is using rubber tired, off-track, haulage equipment and has started to use wire link fence and roof bolts to prevent slabs from caving from the back.

Oliver Iron Mining Division of the U. S. Steel Corporation has applied for and received preliminary approval for exchange of 588 acres of land in Crow Wing and Cass Counties for 400 acres of state owned land near Mountain Iron, Minnesota. The land desired will be utilized for future taconite development, and is adjacent to the present taconite plant near Mountain Iron.

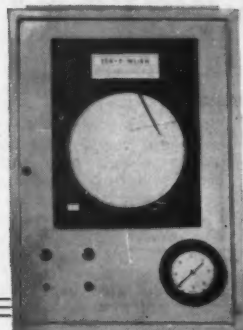
On March 30, small all-rail shipments of special iron ores to Chicago District steel mill were started by Oliver Iron Mining Division. The all-rail shipments originated in the Division's Eastern Mesabi iron range district and averaged about 50 cars per day for a limited period. Special ores are required to produce steels using the "duplexing method," necessitating this "advance of season" all-rail shipment.

The North Range Mining Company has recently closed down all mining operations at the Leonidas underground iron mine located just west of Eveleth on the eastern Mesabi Iron Range. North Range



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### CENTRAL AND EASTERN

has been operating this former Oliver Iron Mining Division mine for the past four years. Lack of a market for the ores is given by the company as the reason for discontinuing mining at the Leonidas.

The Cleveland-Cliffs Iron Company has scheduled a busy mining and ore beneficiation season in Minnesota and Michigan. A new scrubbing plant is scheduled for operation about July 1 at the Homan-Chitts mine on the Mesabi Range. This plant is patterned after a similar plant at the Canisteo concentrator which was placed in operation in 1957 and increased ore reserves. In Michigan further expansion of the Marquette Iron Mining Company's Republic jasperite flotation mill and Eagle Mills pelletizing plant is contemplated in the near future. Cliffs is the operator and owns 47.5 percent of Marquette Iron which increased pellet production from 248,000 tons in 1957 to 525,000 in 1958. A diamond drilling exploration project has also been started by Cliffs on surface lands near Escanaba, Delta County, Michigan. Drilling should continue all summer.

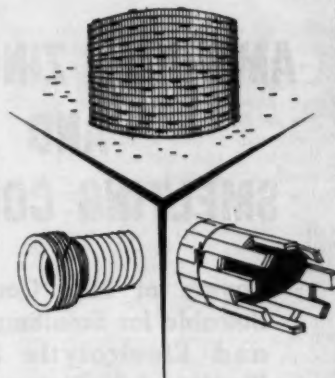
Reserve Mining Company's production of taconite pellets amounted to 4,675,000 tons in 1958, processed from 13,500,000 tons of crude taconite ore. This is almost as high as the record set in 1947, in spite of a 20 percent cutback in operations between March and August because of the decrease in demand for iron ore. Since the first pellets were made at the E. W. Davis Works in October 1955, about 14,500,000 tons have been produced.

Pittsburgh Steel Company of Pittsburgh, Pennsylvania has acquired 78 percent of the Bennett Mining Company of Hibbing, Minnesota by purchasing the interest from Youngstown Sheet & Tube Company and Bethlehem Steel Corporation. Purchase price was not revealed but the cost is to be spread over a four-year period.

Oliver Iron Mining Division of U. S. Steel Corporation has closed its Canisteo District headquarters at Coleraine, Minnesota. Administration of these plants and mines will now be directed from the Hibbing office under John H. Harding, general superintendent. The old Canisteo office will have limited use as a mine office in connection with operating units in the area. The closing was made to improve the competitive position of Mesabi range ores, according to company spokesmen.

Ashland Mining Company, appearing before the Ashland County Board and various state committees, is reported to have said it is ready to spend \$35,000,000 to \$40,000,000 for an open-pit mine and processing plant at its property near Butternut. The taconite ore in this deposit is said to run to a depth of 400 feet or more, and engineers estimate around 250,000,000 tons of taconite could be processed to produce around 70,000,000 tons of pellets.

Final tabulation of iron ore consumption in the United States and Canada for 1958 revealed a decrease of about 36,000,000 gross tons when compared to 1957. United States' reduced consumption accounted for 35,000,000 gross tons of this total. Stockpiles at lower lake ports increased about 2,000,000 gross tons comparing tonnage in stockpile on December 31, 1958, to December 31, 1957. This is a direct reflection of the decreased output of iron ore from the Lake Superior District, since 1958 shipments in this District totalled 32,000,000 gross tons less than 1957 output.



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## INTERNATIONAL NEWS

### Company Formed To Build Rhodesian Copper Smelter

A new smelting and refining plant for production of fire refined copper will be built at Alaska, Southern Rhodesia, by the Messina (Transvaal) Development Company Limited. Operations will be directed by Messina Rhodesia Smelting and Refining Limited, a newly formed company in which Messina holds 80 percent of the stock and M.T.D. (Mangula) Limited, its subsidiary, the remaining 20 percent.

The primary purpose of the plant will be to treat the output of M.T.D. Mangula and other copper properties in Southern Rhodesia as they are brought into production by Messina. It will also operate as a custom smelter. Located on the railroad near Alaska, it is 13 miles west of Sinoia and about 45 miles from Mangula. Completion is expected within 18 months.

Coincident with the opening of the refining plant, Messina's mine at Alaska will start production from a deposit in which 5,000,000 tons averaging 1.8 percent copper have so far been proved. The smelter is expected to reduce costs for both this mine and the Mangula mine.

### Surigao Will Develop Cabigas Iron Claims

Surigao Consolidated Mining Company has signed a contract with Cabigas Mining Enterprises to develop and operate the Cabigas lode mineral claims in the municipality of Pagadian, province of Zamboanga del Sur. The 178 claims are reported to contain high-grade iron ore, with assays ranging up to 70 percent. Preliminary surveys indicate the possibility of a large tonnage of ore, according to the report.

In addition to the main outcrop, large "float" boulders cover an area over 2 kilometers long on the hillsides indicating that an orebody exists in the heavily wooded hills above them.

The Cabigas property is located near the Pioneer Mining Corporation's mine which is now being developed by Surigao. See MINING WORLD, December 1958, page 69, for details of the Pioneer Mining-Surigao Consolidated negotiations.

### Canol Metal Starts Work On Yukon Molybdenite

Canol Metal Mines Limited of Toronto, Canada, is completing necessary construction work prior to full-scale underground exploration of its molybdenum discovery in the Yukon. The company has transported a complete Diesel-powered mining plant by tractor train to its property on the slopes of Stormy Mountain in the Pelly Range, about 90 miles northeast of Whitehorse and about 15 miles off the Canol road. Financing to the amount of \$296,255 has been provided by Jacobus Mining Corporation Limited and associated interests who control issued shares.

On the basis of surface investigations made last fall, the molybdenite discovery is regarded as a high-grade occurrence. However, heavy overburden and permafrost conditions have prevented proper exposure of the structure and underground exploration was recommended. Ore grade mineralization was found in place over a length of 365 feet and over widths up to 40 feet. Length and width of the zone have not yet been determined.

Campsite and the original molybdenum showing are well above the tree-line.

Canol's present plan is to drive an adit as soon as practical after the spring breakup, to permit underground diamond drilling from the adit level. The adit is being sited so that the mineralized zone should be reached within about 75 feet of the portal. It is proposed to crosscut through the full width of the zone to establish a drilling station, following which drifts will be pushed northeast and southwest along the structure with crosscuts at regular intervals to provide further drilling stations.

### Three Shafts and Mill For Swedish Iron Mine

At Malmberget, Sweden, Loussavaara-Kiirunavaara AB has a large expansion project underway to raise iron ore production to 5,000,000 tons in 1961. Three new shaft groups are being sunk to develop the orebody. A new magnetic concentration mill is under construction. The 60-meter-high concrete headframes have been finished over each shaft—the Baron, at the east end of ore body, the Upland, in the center, and the Alliansen, at the west end. Each shaft group has two shafts—one for rock and ore hoisting, and a second for men and supplies. Shaft depth is now 400 meters but equipment and plans call for an ultimate mining depth of 1,100 meters in about 60 years with only minor revisions.

Increased ore production makes it necessary to handle and dispose of waste in a different manner. Accordingly, it will be hoisted to the surface and transported by trucks from head frame bins and dumped into the abandoned open pit. All

iron ore will be hoisted to the 300-meter level, dumped into mine cars, and hauled to the central crushing plant at the west end of the ore body. Each concrete headframe is 60 meters high with two four-rope Koepe hoists mounted on top. Each man hoist has a sheave diameter of 2.6 meters to hoist the cage at 10 meters per second; the ore hoist has a diameter of 3.5 meters to hoist 20 tons of ore at 7.0 meters per second.

A three-section concentration mill is being built with the first section scheduled for operation late this year. The new mill will produce two grades for export and two grades for pelletizing. Ultimate output of three sections will be 2,400,000 tons of shipping concentrate and 600,000 tons for pelletizing. Export concentrate No. 1 grade will assay 70.0 percent Fe, 0.03 percent P; No. 2 grade will be 66.0 percent Fe and 0.2 percent P. The pelletizing grade will be 71.3 percent Fe and 0.01 P.

Wet magnetic concentration will be used, 18 separators per section. Dewatering of concentrate will be on drum filters with concentrates transported by conveyor belts to stockpiles or the new pelletizing plant.

### Moroccan Government Buys Zellidja Mine Interest

The Moroccan government has acquired 18 percent of the stock in the country's largest lead-zinc mines, owned by the Societe des Mines de Zellidja, part of a French combine which operates lead mines on both sides of the Moroccan-Algerian border at Boubecker.

The stock has been purchased by the Office Cherifien des Phosphates, the State-



### South African Sinking Methods Used in England

A team of South African sinking experts have been imported to England to supervise application of sinking techniques at the new vertical shaft of the National Coal Board at Newton-le-Willows, Lancashire. The two, 24-foot-diameter, concrete lined round shafts will be 2,595 feet deep. The photograph shows one of the shafts with the concrete mixing plant in the foreground. This plant serves two shafts with conveyor belts transporting concrete to the top of each shaft where it is transferred to a 6-inch pipe line in the shaft. Ground conditions necessitate concreting within 15 feet of the bottom. Sinking progress has been from 260 to 310 feet in one month. Kinnear Moodie & Co. is the prime contractor with Roberts Construction Co. Ltd. advisor on South African techniques. C. McLauchlan, is the South African technical advisor.



owned phosphate mining monopoly, according to Abderrahim Bouabid, Minister of Economy and Mines.

Zellidja produces 30 percent of Morocco's lead, about 46,000 tons annually, and about 10 percent or 9,000 tons of zinc a year. It also operates the Oued el Heimer smelter, which produces nearly all the country's lead metal (30,000 tons annually).

Labor troubles have arisen recently at the Alzi workings, which are just across the border in Algeria. Miners have been demanding that Moroccan labor laws be applied to Alzi miners, since they are all Moroccan and actually live in Morocco at Boubecker, even though they work on Algerian territory. To date, it has not been the company's policy to apply Moroccan labor laws in Algeria.



**FEDERATION OF RHODESIA & NYASALAND—Rhokana Corporation** has completed a major changeover in the crushing and grinding sections of the Nkana concentrator. Previously, No. 30 McCully gyratories were used for coarse crushing, followed by 7-foot Standard Symons for secondary and 7-foot Short-head Symons for tertiary crushing; a separate screening plant returned oversize to the Symons crushers. Grinding was

achieved in 16, 9-foot by 8-foot Allis Chalmers ball mills. Major changes now completed involve conversion of eight ball mills to rod mills; three of the rod mills and three of the ball mills were lengthened to 12 feet. The tertiary crushers and screening plant have been shut down and ore from the secondary crushers now goes to the rod mills, each of which is followed by a ball mill. Rod mills have not been used on the Copperbelt before, and so the performance of the Nkana mills will be followed with particular interest. Similar installations have been under consideration at other properties.

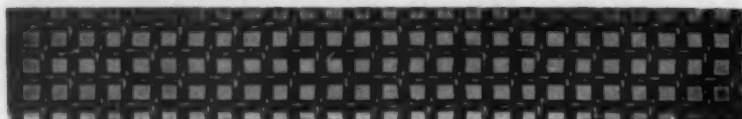
**UNION OF SOUTH AFRICA—Influenced** by the severe faulting immediately south of its No. 1 Shaft, and possibly also by the high-volume water bearing zone which retarded operations to the south of the No. 2 Shaft to the east, **Free State Geduld Mines Ltd.** has decided to sink a 22-foot-diameter vertical shaft, the fifth in the lease area, from a site about 4,000 feet south of the former main shaft. Initially, the shaft will be divided into an upcast ventilation compartment, and a downcast hoisting compartment. Geological information from a borehole being drilled at the site of the projected shaft will determine its final depth. The site is fairly well south of the western section of the water-zone mentioned above.

**GHANA—During** the current year priority will be given to development work at **Bibiani (1927) Ltd.** to open up the southern section on 24 Level and the northern section on the 18, 21, and 24 Levels. The lateral extensions of the northern ore shoots encountered on 14 and 15 Levels will also be determined. In addition, the correlation of these shoots with known ore on 12 Level, as well as with new exposures on 18 Level, will be undertaken. It is intended to maintain the milling rate at approximately the same rate as last year (403,787 tons giving a yield of 77,992 ounces, or 4.7 dwt. per ton), and the Central Quarry will be prepared for working.

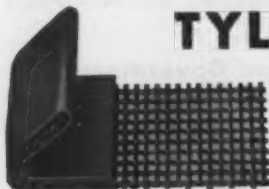
**SIERRA LEONE—British Titan Products Ltd.,** in which **Consolidated Zinc Corporation Ltd.** has a substantial interest, has for some time been prospecting in Sierra Leone in conjunction with **Columbia Southern Chemicals Inc.** but British Titan has now surrendered its rutile interest to Consolidated Zinc. An agreement between the Sierra Leone Government and the joint Consolidated Zinc-Columbia Southern group is in the process of being drawn up to regulate prospecting and mining of rutile for a period of years. When completed, it will be submitted to the House of Representatives for approval.

**GHANA—The Eaton Turner shaft of Ashanti Goldfields Corporation** is back in operation after a faulty hoist drum put it out of service for a while. Gold production the fiscal year ended September 30, 1958 was at a new record level with 282,530 ounces recovered, an average of 23,544 ounces per month. Rate of output has since been increased to 26,000 ounces monthly, and will probably go to 26,500 ounces with the commissioning of mill extensions.

**FEDERATION OF RHODESIA & NYASALAND—Further** drilling to the west of the main orebody by **Chibuluma Mines Ltd.** has outlined a deposit estimated at about 1,000,000 tons of ore assaying 4.05 percent copper, without significant cobalt values. This deposit is not yet included in Chibuluma's ore re-



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serves, and no decision has been made about developing the area.

**BELGIAN CONGO**—During 1958 uranium reserves at Shinkolobwe were reduced to between 5,000 and 6,000 tons of  $U_3O_8$ . A search for additional ore reserves is currently being made in the Katanga district.

**GHANA**—An irregular mineralized zone has been located by diamond drilling carried out by **Konongo Gold Mines Ltd.** in the hanging wall of the Nos. 8 and 9 Levels South. Sampling of 310 feet in this zone (200 feet on 8 Level and 110 feet on 9 Level) gave an average gold content of 12.7 dwt per ton over a width of 65 inches. This type of mineralization has not previously been found at Konongo and its significance is still being determined.

**UNION OF SOUTH AFRICA**—The **Monazite and Mineral Ventures Company**, in the **Anglo American** group, has placed its Monazite mine in the Van Rhynsdorp area of the Northwestern Cape, on a caretaking basis as of March 31. The company's contracts with the United States were fulfilled on that date, and no other sales outlets have been secured. Casual demands will be met from a small stock of concentrates. Sales of the concentrates, mainly on account of the nuclear thorium content, are handled through the **South African Atomic Energy Board**, or by permit from the board. In 1957, sales were valued at £682,879.

**NIGERIA**—A new firm called **Asbestos Cement Products (Nigeria)** will be formed, following the recent signing of an agreement in Rome between the Italian "Eternit" group (which will hold 57 percent), the **West Regional Production and Development Board of Nigeria** (35 percent), and **John Holt & Company of Liverpool** and **Paterson Zochonis & Company of Manchester** (8 percent). The Italian company will build and manage the plant, and will provide the necessary technicians. The British companies will market the products.

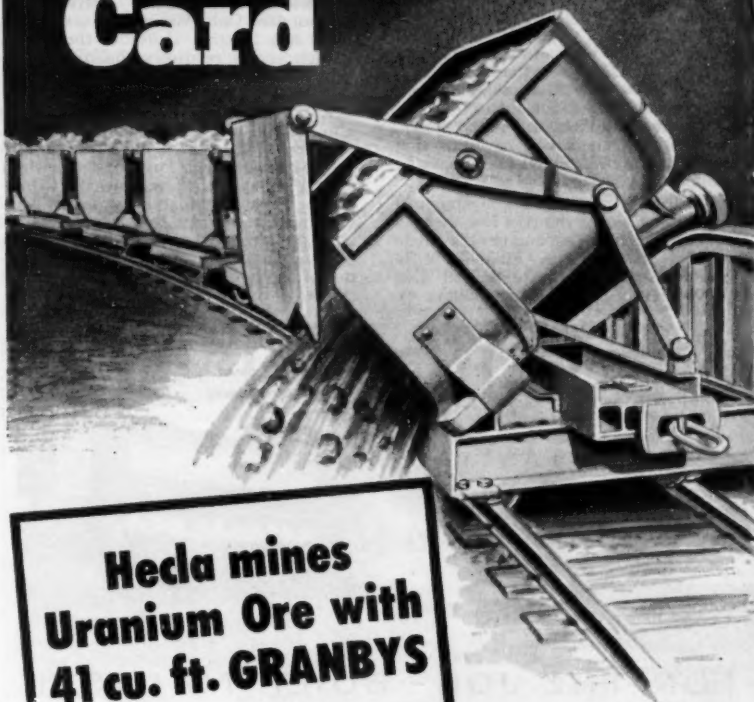
**FEDERATION OF RHODESIA & NYASALAND**—The **Northern Rhodesia Territorial Geological Survey Department** has located sizable deposits of flake graphite about 25 miles from Petauke in the Eastern Province of Northern Rhodesia.

**GHANA**—Main interest in development of **Ghana Main Reef** now lies in the Main Shaft (20th level) and Tuappim (18th level) sections which it is believed hold the key to the mine's future. The average gold value of the total development footage to December 31, 1958 was rather high, that is, 8.08 dwt. over 37.8 inches in the Main shaft ore body, and 13.53 dwt. over 74.9 inches in the Tuappim section.

**UNION OF SOUTH AFRICA**—It has been unofficially reported that a gold-bearing horizon has been located at about 5,000 feet in drilling operations in the Ventersdorp-Coligny Zone. This area is north of Potchefstroom in the Western Transvaal and is currently being explored by **Anglo American Prospecting Company (Africa) Ltd.**, in association with **Unified Gold and Exploration Company Ltd.** Together, they have taken up options over 43,200 claims west of Ventersdorp. Other mining companies are also in the field.

**TANGANYIKA**—Mineral exports in 1958 were valued at £6,262,000, compared with £5,016,000 in 1957. With in-

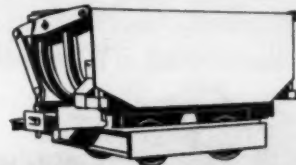
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## INTERNATIONAL

dividual items for 1957 in brackets, the more important exports in 1958 were: diamonds 515,762 carats (372,602); gold 56,299 fine ounces (54,088); lead concentrates 13,501 metric tons (12,635); mica sheet 48,471 tons (66,32); tin concentrates 26.21 tons (20.17).

**FEDERATION OF RHODESIA & NYASALAND**—New Consolidated Prospecting Company, a subsidiary of New Consolidated Goldfields of South Africa, is carrying out an extensive prospecting program in the Balovale district of Northern Rhodesia.

**NIGERIA**—The steady improvement in the price of tin over the past few months has done much to encourage the companies in the Nigerian Tinfield. It is hoped that permitted exports will also improve during the coming months. A

few small contracts for columbite have been signed; any indication of some revival is most welcome.

**UNION OF SOUTH AFRICA**—Blyvooruitzicht Gold Mining Company Ltd., with two hoisting shafts in the central section and a relatively shallow ventilation shaft in the north-central section sub-outcrop zone, has decided to sink another, deeper ventilation shaft from a point about 3,200 feet east of the first ventilation one. This second shaft will be sunk to 5,045 feet, the 6 level horizon, where it will be connected by crosscuts to provide adequate ventilation of deeper level workings, to stabilize future underground pumping arrangements, and to improve hoisting facilities. (The hoisting capacities of the two hoisting shafts may be increased.) Estimated cost of sinking the

shaft over a period of about 4½ years will be £2,720,000, including £465,000 on pumping equipment.



**MALAYA**—A spokesman for Ipoh Mining Company Ltd. reports that his firm is prospecting for additional iron ore deposits in order to meet increasing demands from Japanese iron and steel firms. Three companies now operating in Perak State are producing about 500,000 tons annually, and last year exported 200,000 tons. About 5,000,000 tons are estimated in the state. Ipoh Mining Company recently concluded an agreement with a group of Japanese steel mills to ship 170,000 tons of iron ore to Japan starting on April 1.

**CEYLON**—Ground work will be undertaken this year to check data accumulated during a recent airborne geophysical survey undertaken as an extension of the Colombo Plan sponsored by the government of Canada. About 8,000 square miles of the island were surveyed, flying at approximately 500 feet above the earth.

**INDIA**—The agreement for the barter of one lakh tons of Indian manganese ore and 30,000 tons of ferromanganese ore for 450,000 tons of United States wheat worth \$31,500,000 has been signed by the two governments. Ore shipments are to be completed in 18 months. Exports of manganese ore from India have been improving in recent months, but still have not returned to the levels prevailing before the U.S. recession. Indian manganese producers have been seeking a revision of railway freight rates in order to improve their competitive position in the world market. The Railway Board may investigate the matter shortly.

**JAPAN**—One of Japan's leading aluminum producers, Sumitomo Chemical Company, plans to increase its annual production of primary aluminum by 3,900 tons, to a yearly output of 23,050 tons. The 20 percent increase will be possible in June when 32 large vertical-type electrolytic furnaces are completed and installed. The firm also plans to increase its production of alumina from 270 tons to 280 tons monthly.

**SOUTH KOREA**—Construction of the 80-ton-per-day "synthetic scheelite" plant for Korea Tungsten Mining Company has been completed. Utah Construction Company did the work. The plant will treat low-grade flotation and table concentrates from the Sang Dong tungsten mine. After an initial six-month trial period, the plant will process at a rate of 158 tons monthly.

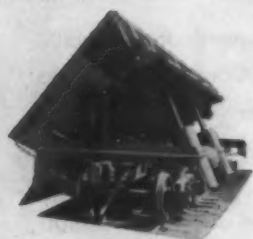
**JAPAN**—With the favorable turn of the copper market, Furukawa Mining Company is considering increasing its present copper output at the Ashio mine and smelter from 1,200 tons to 1,700 tons (blister), or doubling capacity. Ashio uses the flash smelting process developed by the Finnish Outokumpu Company. A second flash smelting furnace could be installed to double capacity. Increased output of the sulphuric acid plant is also under consideration.

**INDIA**—A Japanese mission representing the Fuji Iron and Steel Company has agreed to develop iron ore deposits

# DESIGNED

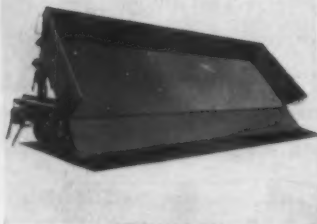


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in the Bailadila area of Madhya Pradesh. The Bailadila project will cost about \$90,000,000, according to the Japanese delegation, and will involve the expansion of the Visakhapatnam port, and construction of a railway from the port to the mine site.

**PAKISTAN**—The headquarters of the Geological Survey of Pakistan, including the office of the Director, have been opened in Karachi. Regional offices will continue to operate in Quetta and Dacca.

**INDIA**—The first ingot of pure uranium was produced recently in India after completion of the metal plant and successful trial runs. Large-scale developments will not be undertaken until later in the Third Plan. The government has decided, however, to install nuclear power plants with a minimum capacity of 250,000 kilowatts.

**PAKISTAN**—Geological experts report that the valleys of the Kohistan area in the former North West Frontier Province can yield between 400,000,000 and 500,000,000 tons of good quality iron ore. There is a rail point at Dargai, only 70 miles south. At Akora Khatak Hills, there is reported to be between 1,000,000 and 2,000,000 tons of hematite ore averaging between 40 and 60 percent pure; and in Kunigram, about 1,000,000 tons of limonite ore is said to be present.

**BURMA**—For the first two years of its operations as a joint venture with the Burma government, **Anglo Burma Tin Company Ltd.** produced only 97 tons and 130 tons of tin concentrates, respectively, and substantial working losses were incurred. In the third year (ended September 30, 1958), with the hydroelectric plant in operation, production amounted to 316 tons of tin concentrates and, for the first time, the company is now working on a profitable basis.

**INDIA**—The first blast furnaces have been commissioned at two of the three new steel plants being erected in India. An output of 1,000 tons of pig iron per day is now coming from the Rourkela plant erected by West German interests, and another 1,000 tons from the Bhilai plant which was equipped by the Russians. Additional furnaces—one at Rourkela and one at Bilharia—are expected to start later in the year. In the fall, the Durgapur plant, built with British financing, is scheduled to start its blast furnace.



**CHILE**—Cerro de Pasco Corporation has been making tests on a 10,000-ton sample of ore from the Rio Blanco property it now has under option. The company has installed a small pilot plant on the Aconagua River and is learning how to treat the ore, what reagents to use, what recovery can be made, etc. in order to determine the feasibility of installing a larger mill. It is also investigating the problem of water supply, mill tailing storage, and river contamination. Rio Blanco property is located on the western slope of the Andes, about 32 miles northwest of Santiago. Core drilling has indicated about 100,000,000 tons of 1.6 percent sulphide copper ore. Cerro de Pasco presently believes that if the property were brought into development it could pro-

duce about 10,000 tons of ore per day, or about 100,000,000 pounds of copper annually.

**MEXICO**—Crosscutting and drifting are scheduled at La Reforma mine, located 350 miles south of Bisbee, Arizona, to test a 1,000,000-ton ore body indicated by drilling of 12 diamond drill holes to depths of 500 feet. Values are in zinc, lead, silver, and copper. The work is being done by **Sheep Creek Mines Ltd.** of Nelson, British Columbia, Canada.

**SURINAM**—The firm of **Friedrich Krupp** of Essen, West Germany has sent a group of technicians to Surinam to investigate potential iron ore deposits in the country. Preliminary investigations indicated there were sufficient deposits to warrant consideration for future development.

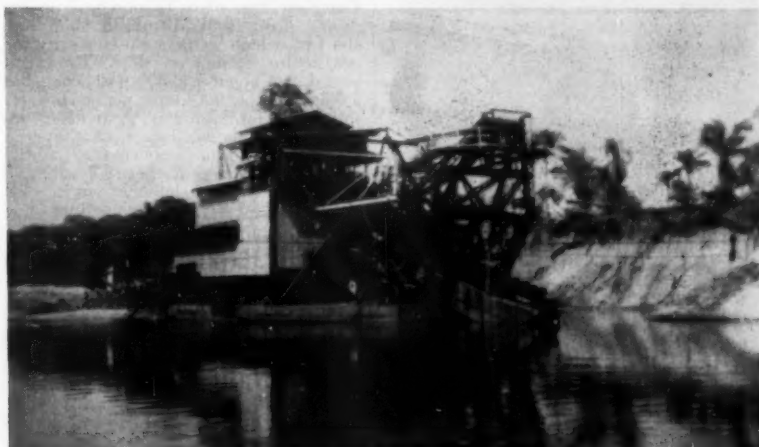
**MEXICO**—Some exploration and development work is being done on a gold and silver property in Guzapares by **Alaska Juneau Gold Mining Company**. The firm has a lease and purchase option on the property, and hopes to decide by July 1 whether it will buy or abandon the property.

**PERU**—**Cia. Minerales Santander Inc.** expects its new mill to be treating 500 metric tons per day by the middle of this month. The mine went into production late in December of 1958. Contracts were negotiated early in 1958 for the sale of lead and zinc concentrates to Europe, and first shipments were made in the first quarter of 1959. **St. Joseph Lead Company** has a 66.7 percent ownership in the Santander operation, and the **Heller-Rosenshine** interests hold the remainder of the stock. The lead, zinc, and silver open-pit mine is located in the Andes Mountains, near the headwaters of the Chancay River.

**CHILE**—**Bethlehem Chile Iron Mines Company** is reported to be planning to expand its iron ore operations in the province of Coquimbo, where it owns the **El Romeral** and **El Tofo** iron magnetite deposits. The company is said to be surveying 150 claims near Los Choros, and is considering erection of a mill to treat the low-grade ore from these claims if survey results are good. The plant would be supplied with electricity from the **El Tofo** plant, since that mine is now almost exhausted. Principal difficulty in the Los Choros area is a scarcity of water for

**COLOMBIA**—Despite the fact that dredge No. 5 was shut down for major overhauling during part of the year, **Pato Consolidated Gold Dredging Ltd.** showed an increase in gold recovery and profit for the year ended December 31, 1958. For the 12-month period, the firm dredged 22,100,000 cubic yards to recover 122,290 ounces of fine gold, compared with 24,768,000 cubic yards dredged in 1957 to recover 111,085 ounces. Net profit for 1958, subject to audit and year-end adjustments, was estimated at \$1,100,000, compared with \$1,040,800 in 1957.

**HAITI**—**Consolidated Halliwell Ltd.** of Canada hopes to bring its Haitian subsidiary, **Sedren S.A.**, into production by the spring of 1960. Additional arrangements for \$3,700,000 in financing were made early this year to bring the 1,500-ton daily rate into actuality, and also provide some working capital. Provision is also being made for easily increasing output to 2,000 tons when needed. Work is under way on three adit levels, sinking of an internal shaft, roads and docks. (See **MINING WORLD**, June 1958, page 83, and August 1958, page 79, for other details of the project.)



## Pampana Dredge To Be Moved To Sarakreek Gold

**North Shore Gold Fields & Mines Limited** of Toronto, Canada has purchased the Pampana dredge pictured here on the Pampana River in Sierra Leone. Plans are underway to dismantle the 4½-cubic-foot, connected, bucketline, Bucyrus-Erie, Diesel-electric dredge, make additions and repairs, and ship it from Freetown to Paramaribo, Surinam. The dredge will then be transported to and rebuilt on the properties of **Sarakreek Goudvelden NV**. **Floyd M. Blanchard** and **Charles M. Thurman**, San Francisco, California placer consultants, met in London recently with representatives of **Sarakreek** and **Brigadier S. A. Westrop**, who operated the dredge. Mr. Blanchard and Mr. Westrop, then went on to Sierra Leone to inspect the dredge. During the London meeting, plans were discussed for building a new hull for the dredge, installing a screen, screen box, jigs, and miscellaneous equipment. Cost studies are being made covering these points. No difficulty is expected in dismantling, rebuilding, and transportation. Studies and opinions by experts indicate that additional equipment will be necessary to completely recover **Sarakreek** gold, a good proportion of which is nuggets.

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**PERU**—Iron ore shipments are expected to start by June from the property of Acari Iron Mining Company (Compania Explotadora de Hierro de Acari). All construction work and mine development projects are well advanced. Initial rate of production is to be 1,000,000 tons per annum.

**CHILE**—A 35,000-gallon-per-day sea water conversion unit will be erected at the new power plant of Chile Exploration Company at Toquepila. There it will convert sea water to fresh water for boiler makeup, and some will also be used for power plant employee consumption. The two-stage flash evaporator costs about \$50,000 and is a complete package. It includes an evaporator, salt water heater air ejector, air ejector condenser, piping, indicating instruments, and related equipment. The power plant, located on the coast, will generate power for the Chuquicamata mine, copper concentrator, and electrolytic refinery and transmit it, via miles of high tension wires, to these facilities.



**NEW SOUTH WALES**—At Cockle Creek, near Newcastle, Consolidated Zinc Corporation Ltd. has decided to proceed with construction of the Improved Vertical Furnace. This plant includes a Dwight-Lloyd sintering machine to treat part of the lead concentrates and zinc concentrates produced at Broken Hill. Smelting is planned to start in mid-1961.

**REPUBLIC OF THE PHILIPPINES**—Ferrum Exploration and Development Company Inc. plans to purchase an ore drying plant from Mitsubishi Shoji Kaisha Ltd. which would be used to dry the ore before loading on ships. The plant would cost about 758,600 pesos, and has a capacity of 600 tons per eight-hour shift. The firm's mining property is located on Homonhon Island, off the coast of Leyte. The firm discovered substantial nickel-iron reserves there after extensive exploration and development work.

**QUEENSLAND**—A newly formed company, Dominion Pty. Ltd., will search for bauxite over an area of 3,520 square miles, situated across the base of Cape York Peninsula. The company is said to be composed of Australian financial interests, reportedly headed by Stanley Korman of Melbourne.

**REPUBLIC OF THE PHILIPPINES**—Surigao Consolidated Mining Company will develop 178 lode claims in Pagadian, Camboanga del Sur, owned by Cabigas Mining Enterprises. Assays of the property are reported to indicate up to 70 percent iron. Surigao will undertake the development in conjunction with its work on the property of Pioneer Mining Corporation located near the Cabigas mines.

**NORTHERN TERRITORY**—Drilling is being conducted on the Outlaw, Skipper Extended, Red Ned, Memsahib, and Kathleen leases by New Merloo Gold Mines N.L. in the Tennant Creek area. The last named has shown some promise. A recent crushing of 141 tons from this lease gave a recovery of 100 ounces of bullion.

**REPUBLIC OF THE PHILIPPINES**—During the month of February, Atlas

Consolidated Mining and Development Corporation's mill on Cebu Island treated 335,598 tons of ore with an average grade of 0.68 percent copper. Copper concentrates produced totaled 7,248,435 dry short tons, assaying 26.72 percent copper and 0.125 ounces gold per ton, and containing 3,879,993 pounds of copper and 906.1 ounces gold.

**REPUBLIC OF THE PHILIPPINES**—Liberty Chromite Mining Corporation recently signed a sales contract for shipment of 2,000 metric tons of chrome ore to Europe. The firm sent a trial shipment of more than 1,000 metric tons to New York last fall where it apparently has been found satisfactory by U.S. buyers. The trial shipment is stockpiled in Baltimore, Maryland where prospective purchasers can inspect the ore and have it laboratory tested. Only 200 tons remain.

**WESTERN AUSTRALIA**—Lake View and Star Ltd., the state's major gold producer, is proceeding with electrification and modernization programs. This is a £300,000 project and is expected to be completed in the present calendar year. A new steel headframe is being erected over the Chaffers shaft. In the past three years, three smaller shafts—the Ivanhoe, Lake View and Associated—have been electrified at a cost of £160,000. These programs are expected to do little more than hold costs at present levels. Like many other gold mines, Lake View has found it necessary to capitalize large sums which can do little more than return themselves over a period of years. The company holds 47 leases covering 684 acres. In recent months, the ore treatment rate has been about 60,000 tons of ore and 70,000 tons of retreated tailings for a recovery of 14,000 ounces of gold.

**REPUBLIC OF THE PHILIPPINES**—A newly organized firm, Cetson Mining Corporation, is planning to develop copper and gold deposits on 50 recently acquired claims in the Bondoc Peninsula of Quezon Province. Engineering studies are said to have indicated deposits capable of major production so the firm is planning to construct a plant in cooperation with Marubeni Iida, Ltd. of Japan. The flotation plant will produce a copper-gold concentrate and a pyrite concentrate.

**NORTHERN TERRITORY**—Tests on ore treatment from South Alligator Uranium N.L. are proceeding in the well-equipped Mines Department laboratories in Adelaide. A plant is also being constructed in Adelaide. Installation is expected to be completed in July and output of U<sub>3</sub>O<sub>8</sub> will start in August. All mining leases in the Slesbeck area held by North Australian Uranium Corporation N.L. have now been purchased by South Alligator Uranium. The Rockhole mine continues to be South Alligator's best prospect but Palette is also promising. (United Uranium N.L. at South Alligator River, which has a larger contract for U<sub>3</sub>O<sub>8</sub> than South Alligator, may have started production by the time this report appears.)

**INDONESIA**—P.T. Perusahaan Belirang Telaga Bodas is currently developing a sulphur deposit in West Java which is considered to be the largest deposit in Indonesia. It has a proved ore reserve of 1,000,000 tons with 50 percent sulphur content. The crude ore is very fine, 95 percent sizing minus-200-mesh (Tyler screen), and the original volcanic mud is very acid because of the sulphuric acid content. After many experiments, the firm

## INTERNATIONAL

found a new process for making pure sulphur, and now obtains 0.4 to 0.45 ton of sulphur per one ton of crude, dry ore with a purity of 99.5 percent. This is reported to be the first flotation process in Indonesia since World War II ended.

**NORTHERN TERRITORY**—A government battery has been reopened at Tennant Creek, hoping to stimulate prospecting for gold and other minerals. Cost was £23,500. Capacity is limited to 8,400 tons per year, but this is not significant at present because only small shipments from prospectors and small syndicates are expected to be available for treatment.



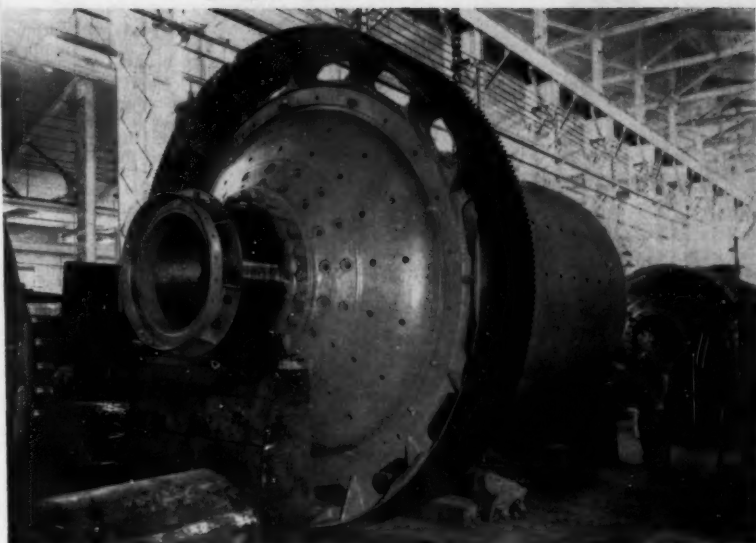
**NORWAY**—Mosjoen Aluminium A/S, which began full production at its new plant in northern Norway just a year ago, is now completing installation of 16 additional electric furnaces. This will increase annual production from 22,000 to 25,000 tons. Plans also call for installation of another 32 furnaces to raise output to 30,000 to 32,000 tons. This stage will be timed to coincide with completion of the new Rossaga hydroelectric plant at the end of 1961. Mosjoen (MOSAL) is a joint venture of Elektrokemisk A/S of Oslo, Norway and Aluminium Industrie AG of Zurich, Switzerland. The Norwegian firm holds two-thirds of the stock.

**SPAIN**—Spanish agents for Signore Nogara of the Banco di Roma, the bank which handles the Vatican's investments, are reported to have leased the fluor spar mine of a Senor Cifuentes, located near Arlos in northwest Spain. The arrangement is based on a per tonnage royalty with a guaranteed annual minimum of 300,000 pesetas to Senor Cifuentes. The mine is said to have a reserve of 1,000,000 tons of ore. It is planned to continue development and to erect a flotation plant during the year.

**U.S.S.R.**—The vice president of the Soviet state purchasing company, Machinimport, is quoted as reporting that his group is negotiating with the London firm of Elliott Automation for the purchase of a £1,000,000 automated plant for smelting copper and other ores. The London firm says it completed a design study of such a plant for the Soviet Union and forwarded it to Machinimport last summer but had received no reply.

**SWEDEN**—Production is scheduled soon from the Strassa mines now being developed by Trafik ab Granesberk Oxelösund. Installation of machinery in the concentration plant is almost completed, and first lowering of personnel has already started with the new Koepe hoist delivered by ASEA. The Strassa mines were abandoned in 1923, then reopened in the early 1950's. After pumping out the main shaft, Granesberg rehabilitated it and also sank another shaft to a depth of 80 meters to serve as the main production shaft. A concrete headframe 50-feet high was also completed.

**NORWAY**—Geophysical and geological exploration and drilling have been continued each summer since 1956 in the Kautogkeino copper district of north Norway. Work so far has indicated about 4,500,000 tons of ore. The project is financed by the Norwegian government,



Hardinge Rod Mill awaiting shipment to the Marquette Iron Range to grind iron ore in a flotation plant.

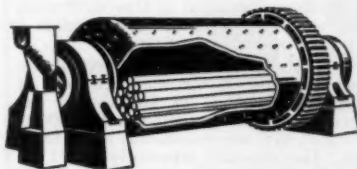
## Hardinge ROD MILLS

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Applications include both open and closed circuit arrangements for ores, aggregates, concrete sand, cokes, and abrasives.

Complete specifications on request. Bulletin 25-C-3



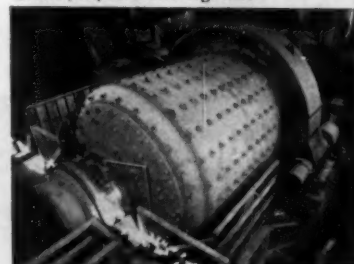
The conical head of the Hardinge Rod Mill provides a feed pocket to allow the charge to enter the rods without overloading or choking.



End peripheral discharge mill



Center peripheral discharge mill



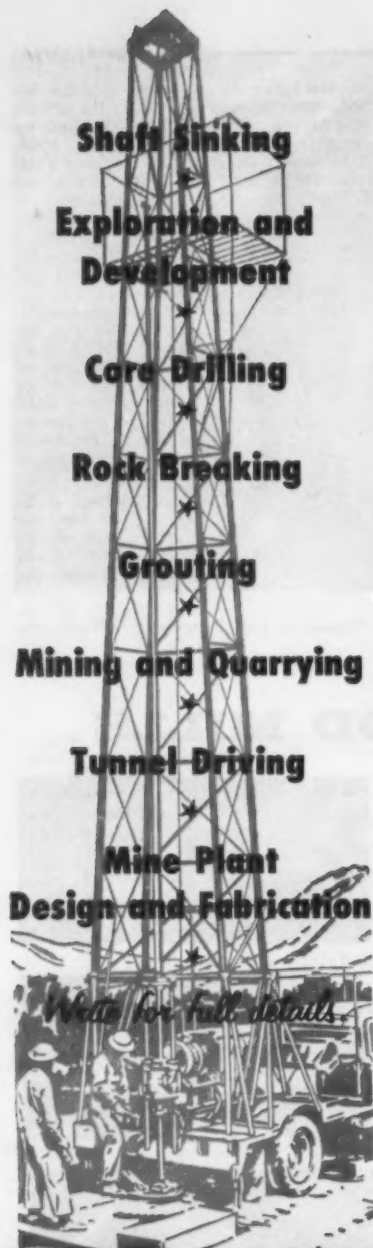
Large Hardinge Rod Mill, grinding lead-zinc ore.

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### INTERNATIONAL

and the Ministry now plans to continue the exploration for one more summer. Though the results have been promising, the ore bodies are located in a remote area far from communications, and so additional ore reserves must be found before it will be worth undertaking production. The district is also called the Bidjovagge district.

**SPAIN**—Fluoruros S.A. is meeting heavy opposition in its plans for a new 1,000-ton-per-day plant which would produce metallurgical and acid grade concentrates. The firm had been planning to invest 25,000,000 pesetas in such a plant to be located near its fluorspar mine at Caravia in northern Spain. Now the local press has started a campaign against the plant, and also against nearby mines, stating that polluted waters are harming tourist trade and coastal fisheries.

**EIRE**—Dewatering to the 1,360-foot level in the Mountain mine has been completed by Emerald Isle Mining Company at Allihies in County Cork. A drive east on the East-West ore body has now been started to locate drill stations for the deep diamond drill holes necessary to evaluate these ore bodies at depth. A drive on the 1,200-foot level is being continued north to the East-West ore body and then west along that ore structure. The firm, a wholly owned subsidiary of Can-Erin Mines Ltd., expects to prove a large tonnage of high-grade copper ore in this area, for it holds six other mines in the same district. Geological investigations at the Hungry Hills mine have given sampling results as high as 9 percent copper per ton of ore, and the consulting geologist states that, together with the low-grade, an average recovery of 3 to 4 percent copper can be expected. Present depth of the mine is 1,300 feet; a diamond drill will be used to prospect to a depth of 2,500 feet.

**SWEDEN**—The Geological Prospecting Department of Sweden, together with LKAB, is now exploring the area around the old Svappavaara ore field where copper was mined until 1686. The area is about 40 kilometers from Kiruna; its surrounding districts are called Levaniemi and Mertainen. Diamond drilling has disclosed iron ore of fairly high quality.

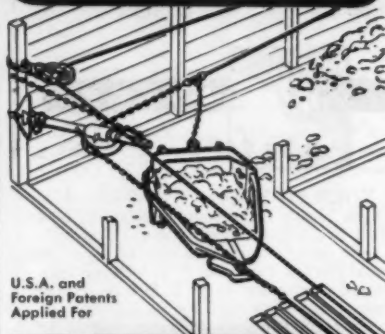
**UNITED KINGDOM**—At Swansea Vale Works, the Consolidated Zinc Corporation Ltd. is currently replacing the horizontal zinc distillation plant with a modern, more efficient smelting plant. The plant will use the new blast furnace process developed by Imperial Smelting Corporation and reported in MINING WORLD, October 1957, pages 58-63. Operation is expected by early next year.

**U.S.S.R.**—A rich iron ore deposit has been reported in the northeast part of the Soviet republic of Kazakhstan. Reserves have been estimated at 4,500,000,000 tons with ore thicknesses of 10 to 20 feet. The deposits reportedly could be partially developed by open pit methods.

**WEST GERMANY**—The technical papers presented at the 1958 International Strata Control Congress held in Leipzig from October 14 to 16 have been printed in English by Helios Literatur-Vertriebs-GmbH. Copies may be obtained for \$17.50 (U.S.) by writing to the company at Berlin-Borsigwalde, Eichborndamm 141-167.

**BULGARIA**—A major iron and steel project is being planned for an area near Sofia where an estimated 250,000,000 tons of iron ore have been located. According to plans, a completely integrated operation is to be built at Krennikowzi to pro-

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ess the ore into rolled steel products. The plant will produce about 1,000,000 tons of steel annually, while iron ore production will be about 5,000,000 tons annually.

**SWEDEN**—The state-owned Luossavaara-Kiirunavaara Mining Company plans to undertake extensive prospecting after 1962. An investigation will be made of old mines and a search will be made for unknown deposits. There are several undeveloped deposits in Lapland, some of which are assumed to contain at least 300,000,000 tons. The company has already placed 4,000,000 Swedish Crowns at the disposal of the Geological Research Society for prospecting of various ore fields.

**UNITED KINGDOM**—A new index of trade names in the industrial diamond and precision tool industry is being compiled by "Industrial Diamond Review" in conjunction with the Industrial Diamond Information Bureau. This is the first review of the index in five years. Entries will show title and address of manufacturing company, together with lists of products and trade names. Companies wishing to be included in the index should write to the Bureau at 2, Charterhouse Street, London E.C. 1.

**U.S.S.R.**—A new aluminum plant in Stalingrad will be able to produce 34 percent more aluminum per kilowatt-hour than older refineries, according to reports from Russia. The plant went into operation in January, and is expected to be the largest in the country by next year when all of its machinery is installed. The goal for aluminum output at the end of the next seven-year plan is 1,600,000 tons per year; much of this would be provided by the new plant.

**FINLAND**—The country's newest mechanized ore port is at Raahen on the coast of the Gulf of Bothnia. The port is equipped with a Goodyear belt conveyor with a maximum capacity of 600 tons of ore per hour. The entire production of the Vihanti mine, owned by Outokumpu Mining Company, totaling 4,000 to 5,000 tons a year, is shipped through this port.

**UNITED KINGDOM**—The position of the Stotsfieldburn mine, operated by The Weardale Lead Company, has greatly improved, and fluorspar reserves are now 12 to 18 months ahead of the mill. Exploration in depth will continue during 1959 since there are indications that there is a "feeder pipe" in this area which could have great possibilities. The company's other property, the Barbary mine, is experiencing great difficulties because of the erratic nature of the vein. Further exploration is continuing, however, since the mine offers the best approach to virgin areas over which mineral rights have been acquired on the strength of favorable reports. To offset the purchase price of these rights, the Killhope leases have been sold; they are inaccessible from present workings.



**LABORADOR**—A \$200,000,000 project is scheduled to get underway in the Wabush Lake area near Carol Lake where Iron Ore Company of Canada will de-

velop extensive iron ore deposits. Completion date is planned for late in 1962 at which time 6,000,000 tons of concentrates will begin to be produced annually. A pilot plant is now being moved onto the property to determine what type of plant will do the ore processing. A 40-mile branch rail line must be built, and it is expected that this will be a joint effort with the Wabush Lake Railway Company which plans to extend its railway to the nearby deposits of Wabush Iron Company. Owners of Iron Ore Company of Canada include Hanna Mining Company, Republic Steel Corporation, Armco Steel Corporation, Bethlehem Steel Corporation, National Steel Corporation, Youngstown Sheet & Tube Company, Hollinger Consolidated Gold Mines, Hollinger North Shore Exploration Company, Labrador Mining and Exploration Company.

**BRITISH COLUMBIA**—Nimkish Iron Mines Ltd. will begin shipping iron ore from its property on northern Vancouver Island this summer. About \$2,000,000 will be spent in preparing the property for production. The firm has already proved around 1,000,000 tons of iron ore and expects to locate even more through exploration. The firm is owned by Standard International Mines, a Canadian subsidiary of Standard Slag Company of Youngstown, Ohio, and International Iron Mines. A contract with Japanese steel companies calls for delivery of 1,000,000 tons.

**QUEBEC**—Sufficient ore is now on hand to permit full-scale operation of Lake Asbestos of Quebec Ltd.'s new mill, although dredging for removal of the

overburden lying above the asbestos ore body will continue until about the middle of this year. During the mill's tune-up period from July to December 31, 1958, it produced 22,800 tons of fibre. Total construction cost of the project is about \$36,000,000. The firm is a subsidiary of American Smelting and Refining Company.

**ONTARIO**—A \$1,000,000 development program, which includes shaft sinking and extensive development work, has been undertaken by North American Rare Metals. A contract was let to R. F. Fry and Associates for a three-compartment shaft which will be sunk to an initial depth of 1,250 feet. A program of 4,000 feet of lateral work and horizontal diamond drilling will probe the magnetite iron formation. Large bulk samples will be tested on a pilot plant scale. The property is located in Scholes Township.

**SASKATCHEWAN**—A diamond drilling program will be carried on this year at the adjoining Amax and Aurora properties purchased by Rix-Athabasca Uranium Mines Ltd. from Pardee Amalgamated Mines Ltd. The firm is deepening the Leonard shaft this year which will increase the number of levels from two to four. Production is being maintained while the shaft sinking goes on. A thorough check will be made of the Smitty reserves which are about depleted.

**QUEBEC**—The Ogilby Norton Company has optioned an iron ore property of Roberval Mining Company in Lyonne Township. The 105-claim group is estimated to contain well over 100,000,000 tons of low-grade, concentrating type open-pit ore. The immediate exploration

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tion program includes 10,000 feet of diamond drilling. The company has a two-year option and will pay Roberval \$10,000 at the end of the first year if it is interested in continuing work. At the end of the two-year period it may then exercise a 99-year royalty lease, and will pay \$10,000 minimum royalties for the first five years, following which it would be increased to \$20,000 whether the property is brought into production or not. A per-ton royalty on all ore shipped will also be arranged for.

**BRITISH COLUMBIA**—The president of Cowichan Copper Company Ltd., O. G. MacDonald, is reported to have been in Japan recently seeking additional investment from Sumitomo Metal Mining Company and Nippon Mining Company in the Cowichan property. The latter is located on Vancouver Island, and has been making regular shipments to Japan under a three-year contract. Sumitomo Mining then sent a Mr. Matsuda to Canada to make a further investigation of the mine.

**ONTARIO**—Steep Rock Iron Mines Ltd. plans to double its iron ore shipments this year because of an improved steel market outlook. In 1958 the firm shipped 1,156,358 tons, compared with 2,348,538 tons in 1957. The company plans a gradual increase toward a goal of 5,500,000 tons annually.

**ONTARIO**—Convex Exploration Company has staked about 1,400 claims in 23 separate groups in the Burnt Bush River area of Ontario. This is the westerly extension of the same greenstone belt of the Mattagami ore bodies, and on the same belt as described in the Quebec

item above. Diamond drilling is underway. Participating in the project with a 20 percent interest is Central Patricia Gold Mines.

**SASKATCHEWAN**—Sinking of two 3,000-foot shafts will start this spring on the magnetite deposit of Kelsey Lake Development Company near Choceland. Kelsey has a work-purchase option on the 105 claims from Irex Iron Mines Ltd. which calls for at least \$150,000 worth of drilling, which has already been spent. The company has an option to buy the property for \$1,500,000 within the next year and a half.

**QUEBEC**—A group of seven companies, under Little Long Lac Gold Mines control, have staked 9,000 acres in portions of Clericy and Joannes Townships. Each of the companies holds its own claims and work done or finds made will be on behalf of the company holding that group. Participating are Perron Gold Mines Ltd., Val D'Or Mineral Holdings Ltd., Hasaga Gold Mines Ltd., Consolidated Red Poplar Minerals Ltd., Hard-rock Gold Mines Ltd., Oklend Gold Mines Ltd., and Pitch-Ore Uranium Mines Ltd.

**ONTARIO**—Frobisher Ltd. appears ready to undertake development of the three iron ore deposits it has outlined near Hermon, northeast of Bancroft. The firm has spent \$600,000 on exploration of the property since 1941. Ore reserves in the Childs and Rankin deposits are estimated at 21,884,727 long tons, grading 16.43 percent magnetic iron. The Bessemer deposit is estimated to contain 2,480,000 long tons, grading 28.62 percent. Preliminary plans call for an output of

350,000 long tons annually, from a 4,000-ton-per-day mill. The Childs and Rankin open pits would be mined first. After nine years, the Childs would be mined out, and ore would then come from the Bessemer, an underground operation, as well as the Rankin open pit. An estimated \$7,100,000 would be needed to bring the project into operation.

**ONTARIO**—Control of Consolidated Howey Gold Mines has been acquired by Dr. N. B. Keevil and associates. This same group also holds shares in Geo-Scientific Prospectors and Mining Geophysics Company; Temagami Mining Company Ltd.; Goldfields Uranium Mines Ltd.; Pickle Crow Gold Mines; Teck-Hughes Gold Mines; Lamaque Gold Mines; and Eldrich Mines.

**QUEBEC**—Shaft sinking will start this spring on property of Portage Island (Chibougamau) Mines where recent drilling has indicated a deep copper-bearing ore zone. The shaft will go to about 600 feet initially to develop one level at this horizon.

**ONTARIO**—Noranda Mines Ltd. reportedly has suspended operations at its sulphur processing plant in the area around Niagara Falls for an indefinite period. The plant started operations in 1954 for the recovery of elemental sulphur and iron oxide from treatment of iron pyrite. It had a daily capacity of 350 tons. Reason for the suspension is attributed to the recent discoveries of natural sulphur in Mexico and other parts of the world which "have made it unfeasible to continue operating the plant under present world conditions".

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## U.S.A. Metal & Mineral Prices

### METALS

APRIL 18, 1959

COPPER: Electrolytic. Delivered F.o.b. cars, Valley basis (pound)	31.50¢
Lake. Delivered, destinations, USA	31.50¢
Foreign. Delivered Destinations, USA	32.00¢
Custom	11.00¢
LEAD: Common Grade. New York (Per pound)	11.00¢
Tri-State Concentrate, 80% lead, per ton	\$127.32
ZINC: Prime Western: F.o.b. E. St. Louis (Per pound)	11.00¢
Prime Western: Delivered, New York	11.50¢
Tri-State Concentrate, 60% zinc, per ton	\$64.00
ALUMINUM: Primary 30 Pound Ingots (99% plus) (Per pound)	26.80¢
ANTIMONY: Lona Star Brand. F.o.b. Larado, in bulk (Per pound)	29.50¢
BISMUTH: (In ton lots) price per pound	\$2.25
CADMIUM: Sticks and bars. 1 to 5 ton lots (Price per pound)	1.30
COBALT: 97.99%, keg of 550 pounds (Price per pound)	\$1.75
COLUMBIUM: Powder	Nom., per pound \$55.00-\$85.00
GERMANIUM: dioxide, high purity, gram	18.50¢
LITHIUM: 98% (per pound)	\$11.00-\$14.00
MAGNESIUM: Ingots (99.8%) F.o.b. Velasco, Texas, per pound	36.00¢
MERCURY: Flasks. Small lots, New York	\$240.00-\$245.00
NICKEL: "K" Ingots (5 pounds). F.o.b. Port Colborne, Ontario	75.50¢
PLUTONIUM: To July 1, 1962 AEC will pay \$30.00 to \$40.00 per gram depending on plutonium 240 content. July 1, 1962 to June 30, 1963, per gram	\$30.00
SELENIUM: 99.5%, per pound	\$7.00
THORIUM: per kilogram	\$43.00
TIN: Grade A Brands. New York (Per Pound) Prompt delivery	\$1.021
TITANIUM: 99.3% + Grade "A" Sponges (Per pound)	\$1.70-\$1.82
URANIUM: Rod (0.790 U-235) \$16.00 Per Pound; Foil	\$16.75
U-235: Nominal (Per pound)	\$7.725
GOLD: United States Treasury Price	\$35.00 per ounce
SILVER: Newly mined domestic. U.S. Treasury price per ounce	90.5¢
Foreign Handy Hammer	9¢
PLATINUM: Per ounce	\$77.00-\$80.00
ZIRCONIUM: Sponge, Per pound, Reactor Grade	\$5.00

### ORES AND CONCENTRATES

BERYLLIUM ORE: 10 to 12% BeO. F.o.b. mine, Colorado \$46.00 per unit	
Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at \$400.00 per short ton or by assaying at: 8.0 to 8.9% BeO, \$40 per unit; 9.0 to 9.9% BeO, \$45; over 10.0%, \$48.00.	
CHROME ORE: F.o.b. railroad cars eastern seaports. Dry long tons	
African (Rhodesian). 48% Cr <sub>2</sub> O <sub>3</sub> . 3 to 1 ratio	\$42.00-\$44.00
African (Transvaal). 48% Cr <sub>2</sub> O <sub>3</sub> . No ratio	\$30.00-\$32.00
Turkish. 48% Cr <sub>2</sub> O <sub>3</sub> . 3 to 1 chrome-iron ratio	Nominal \$50.00
U.S. Government ore-purchase depot Grants Pass Oregon. Buying suspended, quota filled.	
COLUMBIUM-TANTALUM ORE: Per Pound Pentoxide Nominal	\$1.00
IRON ORE: Lake Superior. Per gross ton Lower Lake Ports	
Mesabi, Non Bessemer. 51.5% Fe	\$11.45
Mesabi, Bessemer. 51.5% Fe	\$11.60
Old Range Non Bessemer	\$11.70
Old Range Bessemer	\$11.85
Swedish, Atlantic Ports, 60 to 68% Fe Contracts, Per Unit	25.00¢
MANGANESE ORE: Metallurgical grade. 48 to 50% Mn. Long ton unit	\$1.00-\$1.05
Metallurgical grade. 46 to 48% Mn. Long ton unit	\$0.95-\$1.00
Metallurgical grade. 44 to 46% Mn. Long ton unit	\$0.85-\$0.90
Domestic U.S. Government. Small lot program f.o.b. railroad cars, minimum 40%. Base (48%) \$2.30 per unit with premiums and penalties.	
MOLYBDENITE CONCENTRATE: 90% MoS <sub>2</sub> F.o.b. Climax, Colorado. Per pound Mo, plus container cost	\$1.25
TUNGSTEN CONCENTRATE: Domestic. 60% WO <sub>3</sub> Per short ton unit	Nominal \$21.00
Foreign. 65% WO <sub>3</sub> Per short ton unit (Scheelite)	Nominal \$14.00
Foreign: South American, Spanish, Portuguese	Nominal \$13.00
URANIUM ORE: F.o.b. purchase depot or company mill in accordance with AEC schedules and company buying contracts. Basic price is \$1.50 per pound of U <sub>3</sub> O <sub>8</sub> in ore assaying 0.10 percent. For each additional 0.01 add 20¢. Subject to development allowance, premiums, penalties where applicable.	

### NON-METALLIC MINERALS

BARITE: Oil well drilling. Minimum 4.25 specific gravity, per short ton	\$16.00
BENTONITE: Minus-200-mesh. F.o.b. Wyoming. Per ton, car-load lots	\$12.50
Oil Well grade. Packed in 100 pound paper bags	\$14.00
BORON: Technical grade	F.o.b. Boron, California. Per ton \$47.50
FLUORSPAR: Metallurgical grade, 72.5 % effective CaF <sub>2</sub> content per short ton F.o.b. Illinois-Kentucky mines	\$36.00-\$40.00
Mexican. 70% F.o.b. border	\$26.00-\$27.00
Acid Grade. 97% CaF <sub>2</sub> , Bulk, F.o.b. mine	\$48.00-\$52.00
PERLITE: Crude: F.o.b. mine per short ton	\$3.00 to \$5.00
Plaster grades. Crushed and sized. F.o.b. plants	\$7.00 to \$9.00
SULPHUR: Long ton, F.o.b. Hoskins Mound, Texas	\$25.00
Export	\$24.00-\$25.00

## LONDON METAL AND MINERAL PRICES

April 18, 1959

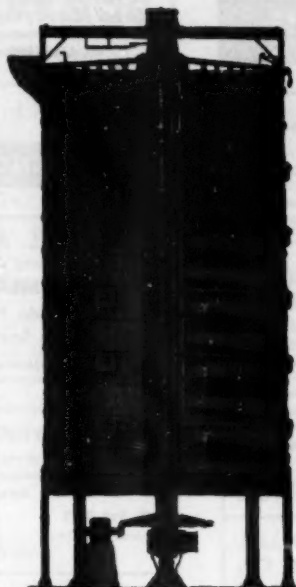
Per Long Ton USA Equivalent cents per pound

COPPER: Electrolytic spot	£232	5s Od	29.03¢
LEAD: Refined 99%	£ 69	7s 6d	8.67¢
ZINC: Virpils, 98%	£ 72	0s Od	9.00¢
ALUMINUM: Ingot, 95.5%	£180	0s Od	22.50¢
ANTIMONY: Regulus, 99.6%	£197	10s Od	24.69¢
TIN: Standard, 99.75%	£783	0s Od	97.88¢
TUNGSTEN: Long ton unit	88s		\$12.32

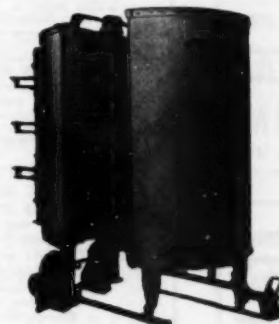
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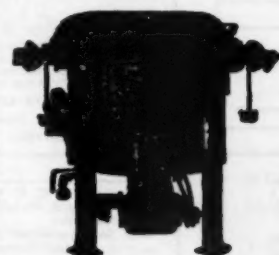
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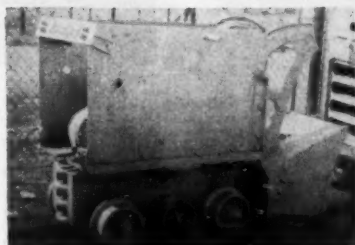
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